THE SYSTEMATICS OF THE PELAGIC SQUID GENUS OCTOPOTEUTHIS RÜPPELL, 1844 (Cephalopoda: Teuthoidea) WITH EMPHASIS ON SPECIES IN THE NORTH ATLANTIC

STEPHEN J. STEPHEN

The Systematics of the Pelagic Squid Genus *Octopoteuthis* Rüppell, 1844 (Cephalopoda; Teuthoidea) with Emphasis on Species in the North Atlantic

by

© Stephen J. Stephen, B. Sc.

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Dedication

To my parents, Joseph and Della Stephen

ABSTRACT

The systematics of the pelagic squid genus *Octopoteuthis* Rüppell, 1844 is reviewed. Four hundred and fifty-six specimens were examined from museum sources worldwide ranging in size from 1.3 mm - 240 mm dorsal mantle length (ML). Of the nine nominal species five are found to be invalid or considered *nomina dubia*. All species are found to bear photophores in a variety of body locations. Characters used to separate species include presence of one or two photophores on the posterior-ventral portion of the mantle; presence or absence of anterior eyelid photophores; presence or absence of an eyeball photophore; and presence or absence of accessory cusps (hooklets) on the arm hooks. Larval specimens (those less than approximately 25 mm ML and still bearing tentacles or remnants of them) could not be separated into species at present because of the late development of the characters defined above. Discriminant analysis run on morphometric data on each specimen supported the species separation proposed here. Geographic and vertical distribution is also discussed.

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Chapter 1
INTRODUCTION

The squid family Octopoteuthidae Berry, 1912 is comprised of two genera, *Octopoteuthis* Rüppell, 1844 and *Taningia* Joubin, 1931. The genus *Octopoteuthis* is represented by nine nominal species presently known to occur circumglobally. All species appear to be mesopelagic as adults (Lu and Clarke, 1975; Lu and Roper, 1979; Young, 1978, 1981; Young and Roper, 1977).

Many of the earliest species descriptions were very brief with few or no illustrations. This made it very difficult to separate species. *Octopoteuthis* adults and larger juveniles differ considerably in appearance from the larvae and smaller juveniles (25-30mm). Also adults and larger juveniles bear distinct photophore patterns and numbers which were neither recognized nor recorded in the earliest species. The loss of many of the species holotypes precluded their re-examination to verify the presence or absence of characters. As a result, considerable confusion has developed in species separation because of inadequate original descriptions, descriptions of species based on larval or juvenile specimens, loss of type material, and the continued addition of new species without clarification of the status of previous ones.

These problems became apparent when the writer was preparing an annotated checklist/key to cephalopods of the Canadian Atlantic for the Huntsman Marine Laboratory, St. Andrews, N. B. (Stephen, 1982, MS). At that time none of the *Octopoteuthis* specimens examined could be assigned to any of the three species reported, in the literature, to occur in the Western North Atlantic. Correspondence with several cephalopod systematists failed to indicate any means to accurately identify specimens of *Octopoteuthis*.

After being accepted to the Masters degree program at Memorial University the writer proposed a project to carry out a systematic revision of the genus *Octopoteuthis* in the North Atlantic. Discussion with my supervisor, Dr. F. A. Aldrich, and correspondence with Dr. C. F. E. Roper, United States National Museum and Dr. G. L. Voss and Mrs. N. A. Voss, Rosenstiel School of Marine and Atmospheric Science, University of Miami, reinforced my idea for the project.

Such a revision required the examination of the largest possible number of specimens from the widest possible distributional range. Since *Octopoteuthis* specimens are caught infrequently, it was necessary to obtain specimens from several institutions. To enable the revision to be comprehensive for the genus, specimens representing Atlantic, Indian and Pacific Ocean species were obtained.

Chapter 2
HISTORICAL RESUME

Rüppell described the first octopoteuthid in 1844 from a young specimen collected off Messina, Italy. He named it *Octopoteuthis sicula*. Krohn (1845), expanded Rüppell's brief description and provided the first illustrations of the species, which showed total dorsal and ventral views, the head and the hooks. In the paper Krohn changed the generic spelling to *Octopodoteuthis* following Rüppell's suggestion: "*Nach Rüppell's Vorschlage nenne ich das Genus wozu die beschriebene Species gehört,* Octopodoteuthis." (p. 49). In 1847, Krohn again changed the generic name to *Verania* after examining a well-preserved specimen which bore small tentacles. He placed his *Verania* in a family Onychoteuthiden, along with the genus *Enoploteuthis* d'Orbigny, 1839.

In 1849, Gray placed *Octopodoteuthis sicula* in his new family Onychoteuthidae. Verany (1851) made *Verania* a subgenus of *Onychoteuthis* Lichtenstein, 1818. Along with a description and a narrative of Rüppell's and Krohn's accounts of the species, Verany provided a ventral view of the gladius. For the next few years the genus was placed in the Onychoteuthidae but the generic spelling varied: *Veranya* (Fischer, 1887; Keferstein, 1866; Pelseneer, 1894; and Tiberi, 1880) and *Verania* (Tryon, 1879; and Weiss, 1889). Pfeffer (1884) used the name *Octopoteuthis sicula*. Woodward (1871) in his "A Manual of the Mollusca" included *Octopodoteuthis* and *Verania* as synonyms of *Enoploteuthis*.

Verrill (1882) included *Verania* in the family Teuthidae Gray, 1849. He assigned the genus a non-supportable characteristic, however, when he listed it as having; "Tentacular club with hooks, ..." (p.280). In 1885, Verrill described a new species, *Ancistrocheirus megaptera* .

Hoyle (1886 a,b) reduced Gray's Onychoteuthidae to a subfamily of Onychii, Steenstrup 1861. The two species were listed as *Verania sicula* and *Ancistrocheirus megaptera*.

Appellöf (1889) gave a detailed description of a larval *Octopoteuthis* and provided some detailed illustrations of the arms, tentacular club, internal viscera, digestive system and optic ganglia. His illustrations clearly showed the photophores on the ink sac and at the ends of the arms although he did not recognize them as such. During the same year Ernest Weiss examined and illustrated a specimen with a mantle length of 7 mm. Weiss misinterpreted the arm tip photophores as hectocotylized or modified portions of the arm of male cephalopods used in spermatophore transfer.

Goodrich, in his 1892 paper, provided a table of chief characters of recent oegopsid cephalopods. His diagnosis of *Verania* was:

> "Arms with 2 rows of hooks. Tentacles short, suckers few. Pen slender, cartilaginous. Fins somewhat rounded, terminal." (p.320).

In the 1896 Monograph by Jatta, the author placed *Veranya sicula* in the Onychii, reviewing the findings of most of the earlier workers who had looked at it. He was the first to illustrate the radula.

In 1899, Ficalbi verified the 1844 date of Rüppell's description of *Octopoteuthis sicula* thereby validating the correct authority for the species. He also reproduced Rüppell's paper in it's entirety, ensuring a larger audience for what had first appeared as a letter from Rüppell to one "m. le Coco".

Pfeffer, in his 1900 "Synopsis der oegopsiden Cephalopoden" assigned *Octopodoteuthis* to his family Enoploteuthidae. Hoyle (1904) maintained Pfeffer's classification and used the following as a diagnosis of the genus:

> "Tentacles absent in the adult; in the young shorter than the arms and with but few suckers on the club; body stumpy and rounded behind; suckers extending to the tips of the arms." (p.11)

Most authors continued to adopt Pfeffer's classification for the next few years (Hoyle, 1909, 1910; Massy, 1909; Pfeffer, 1908; Thiele, 1921).

In 1910, Chun used the spelling *Octopodoteuthis* and created a new family Veranyidae for it based on it's generic synonym *Veranya*. Chun's diagnosis was:

> "Body gelatinous, without luminous organs. Arms with 2 rows of hooks. Tentacles small, deciduous. Club with a small number of biserial suckers. Six buccal pillars; 4th arms attached ventrally. Radula with 5 transverse rows of teeth. Funnel cartilage wide, with a shallow pit which widens posteriorly. Gladius as in *Loligo*." (p.112)

Berry renamed the family Octopodoteuthidae in his July, 1912 paper on Japanese squids. It was not until November of that year that he explained his reasons for the change. He pointed out that Chun's Veranyidae was unacceptable because : "*Verania* is an exact synonym of *Octopoteuthis*" (p.645). Therefore, Veranyidae should be replaced by Octopoteuthidae or Octopodoteuthidae (if Krohn's emendation could be accepted). Several authors, however, continued to use Veranyidae as the family name (Chun, 1913; Murray and Hjort, 1912; Naef, 1916; Pearcy, 1965; and Voss, 1962; 1967).

In Pfeffer's 1912 work *Die Cephalopoden der Plankton-Expedition* he called the group Octopodoteuthinae making it a subfamily of the Enoploteuthidae. He also included therein Verrill's *Ancistrocheirus megaptera* by creating a new genus for it called *Octopodoteuthopsis*.

Several authors, however, continued to use Pfeffer's classification (Joubin, 1920; Robson, 1924; Sasaki, 1916, 1929). Berry (1920a) continued to use the family Octopodoteuthidae but he did include Pfeffer's *Octopodoteuthopsis* in it. Berry's classification was used by the largest number of researchers (Akimushkin, 1963; Bouxin and Legendre 1936; Degner, 1925; Johnson, 1934; Joubin, 1931; Naef, 1921, 1923; Silas, 1968; Thiele, 1935; and Voss, 1956, 1960, 1963).

Naef (1923), in his great monograph on the cephalopods, added two new species of *Octopodoteuthis* to the list. Both his *O. persica* and *O. indica* were based on larval specimens first described by Chun in 1910. Joubin (1931), named the next species *Octopodoteuthis danae* based on a specimen collected by the

DANA expedition near Bermuda. He described the specimen as having 4 pairs of photophores on the body; at the tips of the ventral arms, at the ventral base of each eye socket, on the posterior ventrum of the mantle, and on the recti abdominalis muscles adjacent to the inksac.

In 1948, Robson added a sixth species by his description of *Octopodoteuthis nielseni*, illustrating the funnel organ and a portion of the radula. Robson also questioned Pfeffer's separation of *Octopodoteuthis* and *Octopodoteuthopsis*. He combined these two genera into a single genus *Octopodoteuthis*.

Adam (1952), described a specimen which he identified as *Octopoteuthis sicula*. It bore two pairs of photophores, which he described as ocular and abdominal in their location. He provided illustrations of arm hooks bearing accessory cusps, subordinate to the main median hook, and a radula with nine rows of teeth. He also gave a good synopsis of the work of previous authors and agreed with Robson's consolidation of Pfeffer's adoption of two genera. In 1956(a & b), Voss described a specimen which he identified as *Octopodoteuthopsis megaptera* (Verrill, 1885) and placed in the family Octopodoteuthidae. He found three pairs of light organs; one pair on the recti abdominalis muscles, a second pair on the posterior ventrum of the mantle, and a third pair of ocular photophores. Voss maintained that *Octopodoteuthis* and *Octopodoteuthopsis* were distinct genera. Adam (1960), upon re-examining his 1952 specimens plus one other found the paired ventral mantle photophores similar to the ones decribed by Voss in his specimen of *O. megaptera*. Adam also listed the family to which they were to be assigned as Octopoteuthidae as did Clarke (1966), and Mercer (1968).

Several authors returned to Rüppell's original generic designation *Octopoteuthis* for the species *O. sicula* (Adam, 1952, 1960; Clarke, 1966; Mercer, 1968; Muus, 1963; Pearcy, 1965; Rancurel, 1970; and Voss, 1963).

In 1963, Akimushkin added the seventh species, *Octopodoteuthis longiptera*, collected from a sperm whale (*Physeter catadon*) stomach. He compared *O. sicula* with his new species based on fin, mantle and funnel measurements, locking cartilage shape, and terminal swellings at the tips of the arms. The description of his species was brief and made no mention of photophores. No illustrations were provided.

Roper, Young and Voss (1969), offered a final solution to the problem of generic and familial spellings. The genera *Verania* (*Veranya*), *Octopodoteuthis* (*Octopotheuthis*, an incorrect spelling) and *Octopodoteuthopsis* were made synonyms of Rüppell's *Octopoteuthis*. Berry's Octopoteuthidae was selected as the valid family name.

Young (1972), added an eighth species, *Octopoteuthis deletron*, to the genus. He provided a detailed description of it including information on its ontogeny. He was also the first to describe serial photophores along the course of the axial nerves in the arms. A thorough discussion of the eight nominal species was included. Several species were eliminated or considered *nomina dubia*. *O. persica* was transferred to the species *Taningia danae* based on the specimen's distinct swellings on the tips of arms L and RII and it's extremely broad fins. Young ignored *O. indica* because its small size did not permit adequate comparison with other species. He termed *O. longiptera* a *nomen dubium* because of its inadequate original description and the loss of the holotype which prevented it's re-examination. He identified three species, *O. megaptera*, *O. danae*, and *O.* sp A, from the Atlantic and separated them using photophore patterns, hook structure and tail length. He suggested that one of the species was probably a synonym of *O. sicula*. In the Pacific, Young listed two species, his *O. deletron* and Robson's *O. nielseni*.

Lipka (1975), described brachial photophores from Western Atlantic specimens he identified as *O. megaptera*. His discussion reviewed much of Young's 1972 findings.

In 1980, Clarke named the ninth nominal species, *O. rugosa*, based on a complete female specimen collected from a sperm whale stomach. He reported that he found no light organs in his new species and that Young's suggestion that they were present in all members of the genus was incorrect. Clarke reviewed Young's examination of the genus. Roper, Sweeney and Clarke (1985) also discussed *rugosa* in their work on Antarctic cephalopods.

Nesis (1982), recognized only seven identifiable *Octopoteuthis* species in a key to species of the genus; *O. deletron*, *O.* sp. A, *O. danae*, *O. megaptera*, *O. sicula*, *O. nielseni*, and *O. rugosa*. He commented that Akimuskin's *O. longiptera* was not included because of an extremely incomplete original description.

It is in this confusing state that we find ourselves at the beginning of this current review and, hopefully, rearrangement of the genus, with reference to the Atlantic specimens.

Chapter 3
MATERIALS AND METHODS

The bulk of specimens used in this study were obtained on loan from various institutions. Additional material was examined while on a Short-Term Visitors Appointment to the United States National Museum of Natural History (Smithsonian Institution), Washington, D. C.. The following abbreviations are used to indicate the institutions from which specimens were borrowed:

BMNH - British Museum (Natural History), London.

CSI - CSIRO (Commonwealth Scientific and Industrial Research Organization)

IMPD - Invertebrates and Marine Plants Division, Fisheries and Oceans, Canada, Halifax, N. S.

INAP - Instituto Nacional de Pesca, Montevideo, Uruguay.

MUV - Museum of Victoria (formally National Museum of Victoria), Melbourne, Australia.

NMC - National Museum of Natural History, National Museums of Canada, Ottawa, Ontario.

RSM - Royal Scottish Museum, Edinburgh, Scotland.

SABS - Biological Station, Fisheries and Oceans, Canada, St. Andrews, New

Brunswick.

SAM – South African Museum, Cape Town, South Africa.

SBM – Santa Barbara Museum, Santa Barbara, California.

SIO – Scripps Institute of Oceanography, University of California, La Jolla, California.

SJBS – Biological Station, Fisheries and Oceans, Canada, St. John's, Newfoundland.

TAMU – Texas A & M University, College Station, Texas.

USC – Allan Hancock Foundation, University of Southern California, Los Angeles.

USNM – United States National Museum of Natural History, Washington, D. C..

ZMUC – Zoologisk Museum, University of Copenhagen, Copenhagen, Denmark.

ZMUB – Zoologisk Museum, University of Bergen, Bergen, Norway.

ZMUH – Zoologisches Museum der Universitat Hamburg, Hamburg, Federal Republic of Germany.

In reference to ships the following designations apply:

ABM – R/V *ALABAMA*

ADO – R/V *ANTON DOHRN*

ADM – R/V *ADMIRAL KING*

AFR – R/V *AFRICANA*

AGA - R/V *A. AGASSIZ*

ALM - R/V *ALAMINOS*

ALA - R/V *ALASKA*

ALB - R/V *ALBATROSS*

ARC - R/V *ARCTURUS*

ARG - R/V *ARGUS*

ATC - R/V *A. T. CAMERON*

ATL - R/V *ATLANTIS II*

BAC - R/V *BACHT*

BEL - R/V *BELOGORSK*

CLA - R/V *T. CLARKE*

CLI - R/V *CLIMAX*

COU - R/V *COURAGEOUS*

CRO - R/V *T. CROMWELL*

DAN - R/V *DANA*

DEL - R/V *DELAWARE II*

DIS - R/V *DISCOVERY*

DSJ - R/V *DAVID STARR JORDAN*

GAD - R/V *GADUS*

HAL - R/V *HALCYON*

HMA - R/V *HAKUREI MARU*

HUB - R/V *C. L. HUBBS*

ILL - R/V *ILLOVD*

JOA - R/V *JOAST*

JWS - R/V *J. W. SCOGGAN*

KMA - R/V *KAIYA MARU*

LHA - R/V *LADY HAMMOND*

MNA - R/V *MEIRINE NAUDE*

MSA - R/V *MICHAEL SARS*

PEN - R/V *PENALBA*

SAN - R/V *SANDS*

SMI - R/V *H. M. SMITH*

SOE - R/V *SOELA*

SPE - R/V *SPENCER*

SPR - R/V *SPRIGHTLY*

SWA - R/V *SWAN*

TAI - R/V *TAIT*

VEL - R/V *VELERO*

WAS - R/V *T. WASHINGTON*

WHE - R/V *WALTHER HERWIG*

WIG - R/V *WIGWAM*

In reference to program the following designations apply:

EAS - R/V *EASTROPAC* plankton sampling program at SCRIPPS

Gear employed in capturing the *Octopoteuthis* spp. reported herein are designated as follows:

BONG - Bongo

BT - Beam Trawl

COBB - Cobb Midwater Trawl

E300 - 3 metre Ring Trawl

EMT - Engels Midwater Trawl

IKMT - Issacs-Kidd Midwater Trawl

MOC - Multiple Opening-closing Net Environmental Sensing System

MOT - Monsoon Midwater Trawl

MWT - Midwater Trawl

NAN - Nanaimo Midwater Trawl

OTT - Otter Trawl

RMT - Rectangular Midwater Trawl

S150 - 1.5 metre Stramin Net

S200 - 2.0 metre Stramin Net

TUCK - Tucker Trawl

mw - metres of wire out

Measurements and counts are those recommended by Roper and Voss (1983). All measurements were taken by means of a steel centimeter rule or metric calipers, and are presented in millimeters (mm). The following abbreviations are the data categories measured or computed. The definitions of some of the actual measurements are inherent in the definition of the indices. Figures 3-1, 3-2 and 3-3 illustrate where the measurements were taken on each specimen.

Figure 3-1: Generalized drawing of a squid of the genus *Octopoteuthis* (dorsal view) showing dimensions and structures measured in review of proposed diagnostic characters.

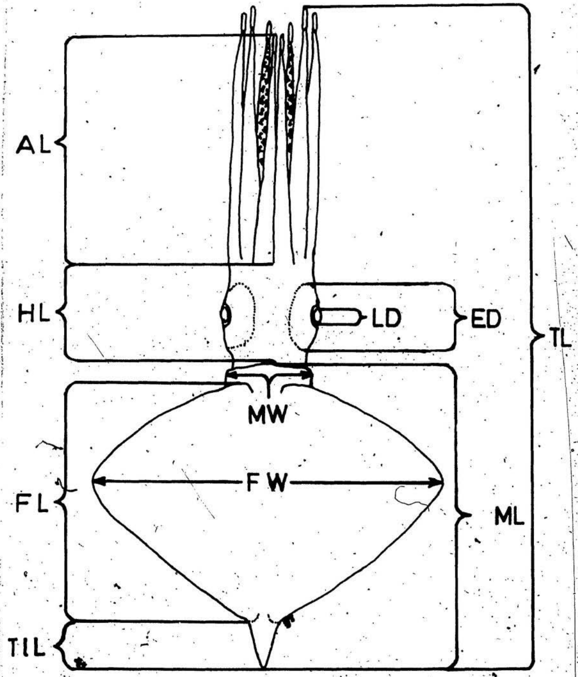

AL
HL
LD
ED
TL
MW
FW
FL
ML
TIL

Figure 3-2: Generalized drawing of a squid of the genus *Octopoteuthis* (ventral view) showing position of photophores. ATP - arm tip photophore; AP - arm photophore; AEP - anterior eyelid photophore; VHP - ventral head photophore; VP - viceral photophore; PVMP - posterior ventral mantle photophore.

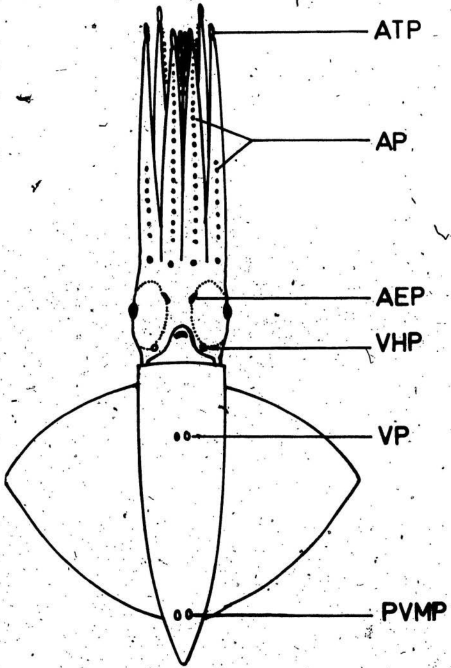
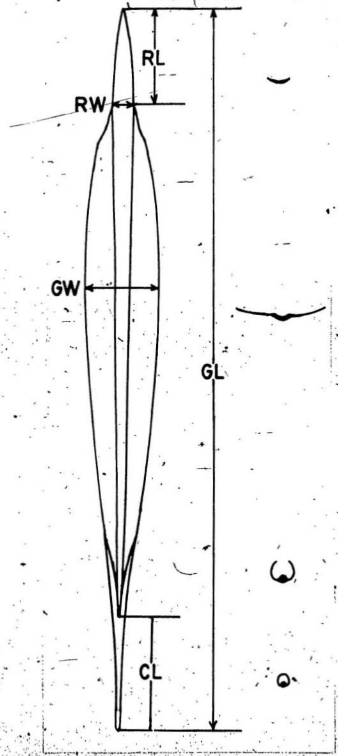

ATP
AP
AEP
VHP
VP
PVMP

Figure 3-3: Generalized drawing of the gladius of Young's *Octopoteuthis* sp A showing cross sectional configurations and the axes of which measurements were taken.


RL
RW
GW
GL
CL

AF - Arm Formula: comparative length of arms expressed in decreasing order.

HC - Arm Hook Count: number of hooks on each designated arm.

AL - Arm Length (I, II, III, IV).

ALI - Arm Length Index: length of arm measured from the first basal (proximal-most) hook to the tip of the arm as a percentage of mantle length. (Arm I, dorsal; II, dorso-lateral; III, ventro-lateral; IV ventral)

ED - Eye Diameter.

EDI - Eye Diameter Index: greatest diameter of eye as a percentage of mantle length.

FL - Fin Length.

FLI - Fin Length Index: greatest length of fin (excluding tail) as a percentage of mantle length.

FW - Fin Width.

FWI - Fin Width Index: greatest width (dorsally) across both fins as a percentage of mantle length.

GL - Gladius Length: dorsal length of gladius along midline.

GLI - Gladius Length Index: length of gladius as a percentage of mantle length.

GW - Gladius Width.

GWI - Gladius Width Index: greatest width of gladius as a percentage of gladius length.

HL - Head Length.

HLI - Head Length Index: dorsal length of head measured from point of fusion of dorsal arms to anterior tip of nuchal locking cartilage as a percentage of mantle length.

HW - Head Width.

HWI - Head Width Index: greatest width of head at level of eyes as a percentage of mantle length.

LD - Lens Diameter.

LDI - Lens Diameter Index: diameter of eye lens as a percentage of mantle length.

ML - Mantle Length: dorsal mantle length measured from anterior-most point of mantle to posterior apex of mantle.

MW - Mantle Width.

MWI - Mantle Width Index: greatest straight-line (dorsal) width of mantle as a percentage of mantle length.

RL - Rachis Length.

RLI - Rachis Length Index: length of free rachis measured from anterior end of gladius to point where anterior end of vane joins rachis, as a precentage of gladius length.

RW - Rachis Width.

RWI - Rachis Width Index: width of rachis measured at point where anterior edge of vane meets rachis as a percentage of gladius length.

TlL - Tail Length.

TlLI - Tail Length Index: portion of the mantle measured from the posterior edge of fins to the distal tip of mantle as a percentage of mantle length.

TtL - Tentacle Length.

TtLI - Tentacle Length Index: total length of tentacular stalk and club as a percentage of mantle length.

TL - Total Length: measured from the tip of club (or longest arm in juveniles and adults) to posterior-most point of mantle.

Photophore numbers and placement were determined by minor microscope dissection. Axial nerve photophores were uncovered by making an incision along the length of all arms and by examining them using a dissecting microscope. Due to the extreme difficulty in determining arm photophore numbers without causing some damage to intact arms, specimens were X-rayed in an attempt to see if arm photophores could be seen on the film and counted. No photophores were visible on the film so after several attempts the procedure was abandoned.

The gladius was extracted for examination using the method described by Toll (1982), which requires displacement of viscera from the left side to the animal's right, slicing through the stellate ganglion thereby permitting easy removal of the gladius from the shell sac. The gladius thus acquired was stained by use of methylene blue and required measurements were taken with vernier calipers. Beaks and radula were removed for examination by excising the complete buccal mass from the squid and then soaking the mass in a 10 percent solution of potassium hydroxide. The potassium hydroxide digested adhering tissue and after rinsing in distilled water the beaks were measured using Vernier calipers. The radula was photographed using a WILD Photomat MPS 55 dissecting scope/camera combination.

A number of additional characters were looked at including; funnel locking cartilage, nuchal cartilage and funnel organ sculpturing, and the number and type of brachial armature (ie. hooks and sucker counts).

Statistical analysis of the morphometrics was done using SAS software package (SAS, 1982) on the Memorial University VMS (DIGITAL) computing system. Initially, it was planned to analyze all morphometric and meristic variables but the loss of the arm tips of the majority of the specimens precluded the use of arm and total lengths, hook and sucker counts and axial photophore counts. Thus, only the following measurements were analysed statistically in individual species; mantle width, fin length, fin width, head length, head width, tail length, eye diameter, and lens diameter. Additional measurements analysed in larvae included tentacle length, and arm lengths.

Indices (means, maximum and minimum values) were calculated for the larvae, and individual species. The species indices were generated for size ranges of 25 mm ML intervals. Larval indices were generated for size ranges of 5 mm ML intervals.

Means comparisons, using the general linear models (GLM) procedure, were carried out on juvenile and maturing animals separated into 5 species defined by photophore position and number and hook structure. Each variable was analysed separately in individual GLM procedures. During each procedure the defined variable was compared for all species simultaneously. Each GLM indicated which means differed significantly (at the .05 per cent level) between species.

Discriminant analysis was then run on the same morphometrics using the discriminant analysis (DISCRIM) procedure. The procedure classified specimens into one of the 5 defined species based on analysis of the morphometrics. It also reclassified any observations that appeared to be misclassified originally and listed the number of observations and per cents classified into species. After the first DISCRIM procedure was completed it was found that one of the defined species *O.* sp A had very low numbers (5) and was not being treated with full matrix ranking. A second DISCRIM procedure was therefore run without the species.

Chapter 4
RESULTS

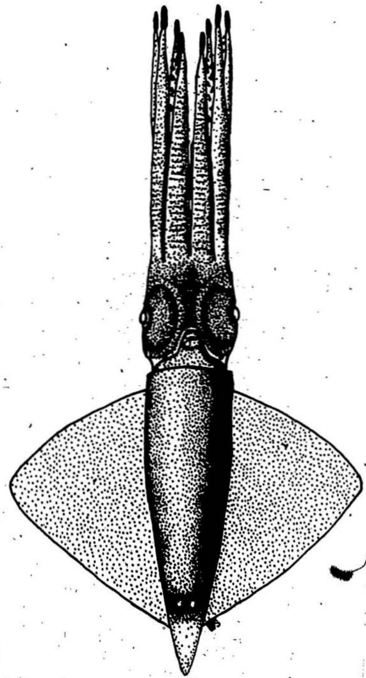
4.1. GENERAL MORPHOLOGY

Specimens of the genus *Octopoteuthis*, like other decapod squids, bear eight arms and two tentacles. The paired tentacles common to most squids are retained only during the larval period. By the time the animals have reached a dorsal mantle length of 25-30 mm, the tentacles are autotomized, the stumps being gradually resorbed. As adults the animals have large rhomboidal fins extending almost the total length of the mantle. Fin width is usually greater than mantle length (See Fig 4-1).

The *mantle* is conical, tapering gradually posteriorad. It is composed of layers of muscles internally and a gelatinous outer layer which contains ammonium and is thought to aid the animal in maintaining buoyancy (Clarke *et al.*, 1969; Clarke *et al.*, 1979; Denton and Gilpin-Brown, 1973). Both the gelatinous and muscular layers are heavily pigmented giving preserved specimens a rich purple-red colour. In mature females (of all species) the gelatinous layer at the anterior end of the mantle, near the funnel, becomes rugose.

The *arms* are nearly equal in length to the mantle and bear biserial hooks and suckers. These hooks, numbering around 40-60 per arm, are formed by the modified chitinous rings of the original arm suckers. A few (6-15) suckers remain near the distal end of each arm. The arms also have a gelatinous outer layer

Figure 4-1: Drawing of a Generalized Adult squid of the genus *Octopoteuthis* (ventral view). (Scale = 10mm)



although most specimens lose much of this during capture. The gelatinous layer is not pigmented but underlying it on arms III and IV on most specimens is a layer of chromatophores arranged in parallel rows running across each arm. This has been previously noted only in *Octopoteuthis deletron* Young, 1972; and *O. rugosa* Clarke, 1980.

Each species bears a number of *photophores* found in various locations on the body; ventrally on the posterior portion of the mantle, ventrally overlying the ink sac, one anteriorly on the tissue of the eyelid and another posterio-laterally to the eye between the eyelid and the olfactory papillae (and in some, on the eyeball as well), at the proximal base of each of the arms, and in a series parălleling the axial nerves of the ventral and two lateral pairs of arms. Elongate photophores are also found on the distal tips of each arm. Almost all of these photophores are situated in such a way that light they emit is directed ventrally (Young and Roper, 1977). The high incidence of arm tip loss eliminated the use of axial photophore counts as a possible aid in species identificaton.

The *head* is also covered by a gelatinous layer of tissue. The eyes are large, their diameter almost equal to the head length. There are two "olfactory" papillae, ventrally situated on the head, one on either side of the funnel. The funnel extends almost to the midpoint of the eye. The funnel locking apparatus is of a modified, simple, straight type which generally widens posteriorly. The funnel organ consists of an inverted V-shaped dorsal pad and two oval ventral pads. There is a papilla on a small ridge at the apex of the dorsal pad and longer ridges running partway down each side of the V. There was no discernable difference in the sculpturing of the funnel locking cartilage, the nuchal cartilage or the funnel organ in any of the species of *Octopoteuthis* examined.

Sexual maturity, in both sexes, seems to occur at a varying size range starting at around 80.0 mm mantle length (ML). *Gravid females* have very large nidamental (85 mm in a 215 mm ML female) and oviducal glands. The mature eggs are slightly oval and about 2 mm in diameter. In *mature males* the penis is very large extending, in some specimens examined, beyond the mantle cavity opening. Unlike the males of other teuthoid squids, those of *Octopoteuthis* lack a hectocotylus (the modified arm tip(s) used in spermatophore transfer).

The *radula* is composed of seven rows of teeth, one median row and three lateral rows to either side.

The *gladii* in the genus have been inaccurately described in the past. Most illustrations and descriptions were based on very small specimens and were drawn with little or no detail (Jatta, 1896; Adams and Adams, 1858). Structurally the gladius consists of a short free rachis, and wide vanes that join together posteriorly to form a conus (see Fig 4-2).

As stated earlier in this section, *larvae* differ from juveniles and adults in several ways. Fig 4-3 shows the ontogenetic development of three larvae from 5.0 to 10.9 mm ML. They bear very wide fins, like the adults, but the fin length is less than half that of the mantle. Photophores are not present in the larval forms to the degree they are in the postlarval and adult configuration. An exception to this generalization is the case of the photophores found at the distal termination of the arms.

A total of 455 specimens of *Octopoteuthis* were examined representing collections from the North and South Atlantic, the NE Pacific, the Indian Ocean, the SW Pacific in the vicinity of Australia and from the Mediterranean Sea. Sizes of specimens ranged from larvae of 1.7mm ML to the largest adult of 240mm ML.

Of the nine nominal species described only four still have extant types; *Octopoteuthis danae*, *O. nielseni*, *O. deletron*, and *O. rugosa*. Only the *O. deletron* and *O. rugosa* holotypes are adult animals. Both the syntypes of *O. nielseni* and the holotype of *O. danae* are juveniles.

The following sections deal with each nominal species separately, giving

Figure 4-2: Drawings of (a.) the gladius and (b.) beaks of *Octopoteuthis deletron* Young, 1972, and (c.) arm hooks (with and without cusps). (Scale = 10mm)

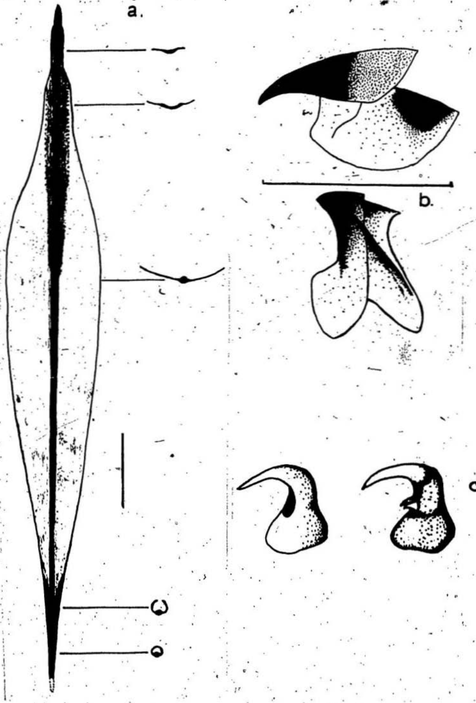
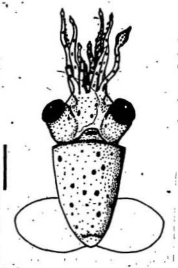
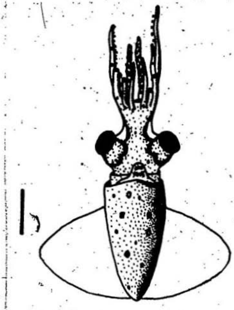
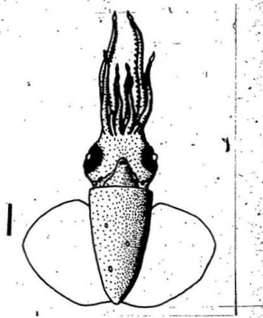

a.
b.
c.

Figure 4-3: Drawings of larval squid of the genus *Octopoteuthis* showing ontogenetic changes in general morphology (Scale=2 mm).







information on the type specimen(s) followed by a full description of each species listing characters of the species along with specific comments on the type(s). Where no type specimens exist the original description is given. Only two of the original nine nominal species could be clearly distinguished, *danae* and [deletron]. Three other species, temporarily designated as A, B, and C could be identified using the same criteria. To attempt to stabilize the systematics of the genus *Octopoteuthis* species B and C were used as the bases to redescribe the two oldest species, *sicula* and *megaptera* respectively. The reasoning for each choice will be discussed in the appropriate section below.

4.2. Octopoteuthis sicula Rüppell, 1844

SYNONYMY.-

as *Octopoteuthis sicula* Rüppell, 1844; Pfeffer, 1884 Ficalbi, 1899; Degner, 1925; Adam, 1952, 1960; Clarke, 1966, 1980; Young, 1972; Nesis, 1982

as *Octopodoteuthis sicula* Krohn, 1845; Pfeffer, 1900; Hoyle, 1909; Pfeffer, 1908; Thiele 1921, 1935; Chun, 1910; Naef 1921, 1923;

as *Verania sicula* Krohn, 1847; Tryon, 1879; Verrill, 1882; Hoyle, 1886 a, b; Weiss, 1889; Goodrich, 1892;

as *Octopodoteuthis sicula* Gray, 1849

as *Onychoteuthis (Verania) sicula* Verany, 1851

as *Veranya sicula* Keferstein, 1866; Tiberi, 1880; Fischer, 1887; Pelseneer, 1894; Jatta, 1896;

as a synonym of *Enoploteuthis* in Woodward, 1871

Type: Juvenile, 44 mm ML, not extant.

Type Locality: From off Messina, Italy, 27 February 1844.

Material examined: see Appendices I and II.

DESCRIPTION.-Translated from Rüppell, 1844.

" Finally, however, our honourable friend Dr. Krohn who is preparing the publication of a new genus of cephalopod, he recently uncovered, which I also collected and observed alive, permitted me the opportunity to give a short note calling it to the attention of Sicilian malacologists. This genus that is decreed to be called

Octopoteuthis.

combines the characteristics of the species *Octopus*, *Loligo*, and *Enoploteuthis*. In it, the head, the mouth of which is surrounded by eight tentacles equal in length and equipped with a double longitudinal set of little hooks, rests on a visceral sac which is conical, funnel-shaped and supported by a very thin horny layer and which has on its dorsal side for two-thirds of its length towards the apex, a large fin-like subcordiform membrane.

We call this species

Octopoteuthi siculiana

Octopoteuthis sicula

This has under the head a small, fleshy prolongation, thirty pairs of tiny hooks in alternate rows above each tentacle. The live animal is a translucent rosy colour, the ends of the tentacles a deep red.

In the dead animal the chromatophores produce many yellowish-red spots over the whole surface. The total length of the body and the tentacles is from 2.5 inches and the maximum transverse breadth of the fin is from 15 lines.(a line= one 12th of an inch)*

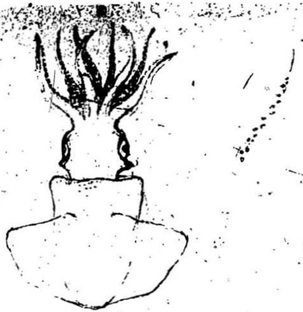
DESCRIPTION.-*O. sicula*, an Atlantic and Mediterranean species, closely resembles *Octopoteuthis danae* although it does bear characters that separate the two.

The *mantle* is conical and covered with a gelatinous layer. The tail length is approximately 14 per cent of the ML.

As in other species the *fins* are large and muscular. Fin length is 75 per cent of the ML while the fin width is 115 per cent of ML.

The *head* itself is robust with thick outer gelatinous layer.

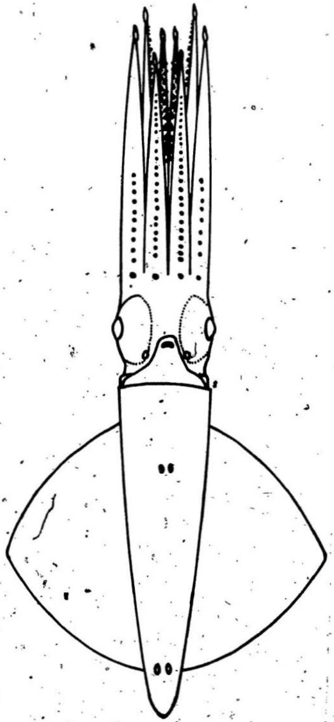
Figure 4-4: Photograph of Rüppell's original unpublished illustration of the holotype of *Octopoteuthis sicula*. (Courtesy of Ronald Jannsen, Curator of Invertebrates, Senckenberg Institut, Frankfurt, F. D. R.).



Nov. Genus. Octopodoteuthis sicula, Krohn.

Nur acht Arme; jeder mit doppelter Reihe von
je 20 & mehr Paar Saugnäpfe, [illegible] angeordnet
[illegible] mit großen Flossen [illegible].
[illegible] Körper [illegible] mit [illegible]
Körperfarbe im Leben [illegible], nur das Ende der Arme [illegible] röthlich
nach dem Tode überall feine [illegible] gelbe Punkte;
Stelle der Augen eine [illegible]
Körper Länge ohne Kopf 1 Zoll. Breite der Schwimmflossen
das ganze Thier 2½ Zoll.
Messina 27/2 1844.

Figure 4-5: Drawing of *Octopoteuthis sicula* Rüppell, 1844 showing photophore patterning.



The *funnel* is large and extends about half-way along the length of the head.

The *arms* have hooks which bear accessory cusps unlike the closely related species *Octopoteuthis danae*. The arm formula was II>III>IV>I in a 215 mm ML female.

A pair of *photophores* is found ventrally on the posterior portion of the mantle. There is a pair of photophores located ventrally adjacent to the ink sac, and a single photophore at the posterio-ventral position of each eye. The arms III and IV each have a series of axial photophores (43 and 25 respectively in a 215 mm ML female). (See Fig 4-5)

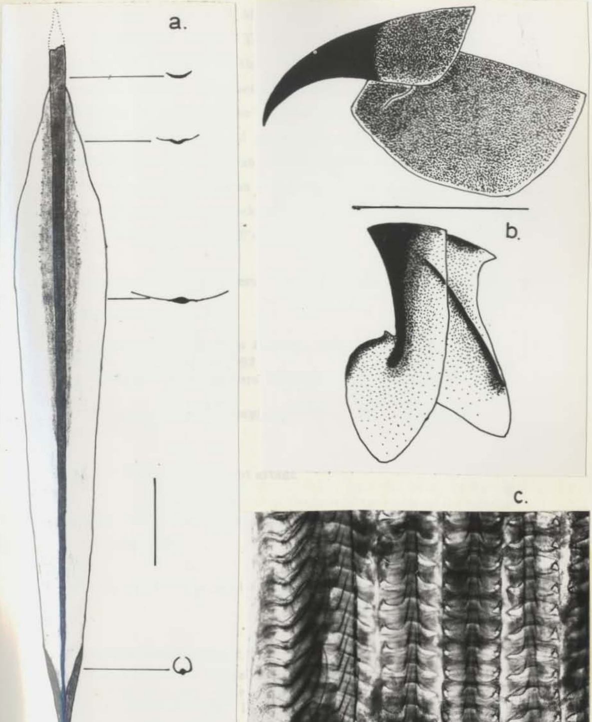
The *gladius* has a short, free rachis with RLI and RWI of 10 and 2 percent respectively. The rachis begins to form a dorsal keel about 1/3 of the way down its length. Anteriorly the vanes taper down to the rachis in a series of three gradual contractions. The vanes (GWI = 12 percent) begin to curl ventrally about 85 percent of the way down the gladius. The vanes which form the secondary conus (CLI = 2 percent) do not begin to fuse until the vanes have run together for a distance greater than the conus length. (See Fig 4-6)

The *radula* has a tricuspid rachidian, bicuspid first lateral, and unicuspid second and third laterals. The outer cusps of the rachidian and first laterals are small. The rostrum of the lower *beak* is about 1/3 the length of the wing. The rostral edge is almost straight with a hooked tip and the jaw angle is obtuse. The upper beak has a greatly curved rostrum and the jaw angle is acute.

DISCUSSION.-The type specimen of *sicula* could not be traced; however Rüppell's original unpublished illustrations (see Fig 4-4) of the specimen were located at the library of the Senckenberg Institute in Frankfurt, Germany.

The illustrations give no indications of the photophore pattern of the specimen so little could be determined except the animal's basic habitus.

Figure 4-6: Drawings of (a.) gladius (with cross sections), (b.) beaks and a photograph of (c.) portion of radula from specimens of *Octopoteuthis sicula* Rüppell, 1844. (Scale = 10 mm)


a.
b.
c.

A single specimen collected from Messina, Italy was examined from the collections of the Royal Scottish Museum. It is a 28.3 mm ML animal bearing a pair of abdominal photophores. The hooks have all been dissolved away during preservation but it appears by the intact hook sheathing that accessory cusps were probably present. No photophores were visible on the eyeball or the anterior portion of the eyelid. The species B listed above bears paired abdominal photophores, no eyeball or eyelid photophores and hooks with accessory cusps. The similarity of the characters and the distribution of B throughout the North Atlantic including the Mauritanian subprovice associated with the Mediterranean subprovince (Backus and Craddock (1977) and Backus *et al.* (1977)) imply that species B is most probably Ruppell's *sicula*.

4.3. Octopoteuthis megaptera (Verrill, 1885)

SYNONYMY.-

as *Octopoteuthis megaptera* Clarke, 1966, 1980; Young, 1972; Lipka, 1975; Nesis, 1982

as *Ancistrocheirus megaptera* Verrill, 1885; Hoyle 1886 a, b;

as *Octopodoteuthopsis megaptera* Pfeffer, 1912; Berry 1920 a; Voss 1956 a, b;

Holotype: Juvenile, 44 mm ML, not extant.

Type Locality: *ALBATROSS*, Sta 2235, 39° 12'N, 72° 03'W, 1500 mw, 09:49, 13 September 1884.

Material examined: Holotype not located. For other material see Appendices I and II.

ORIGINAL DESCRIPTION.-

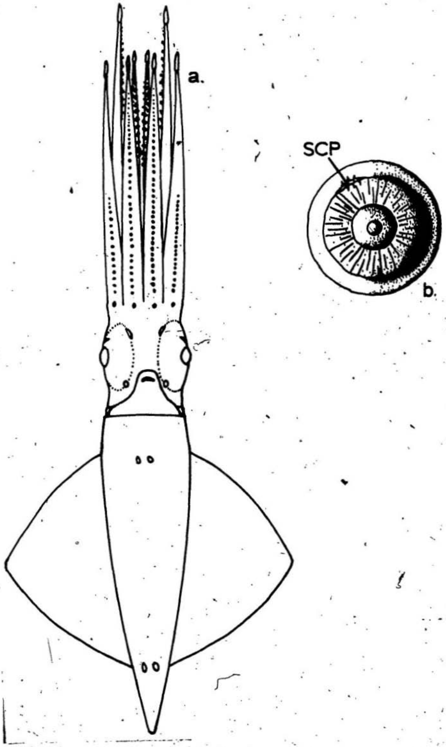
"*Ancistrocheirus megaptera* Verrill, sp. nov. Body small, rather short, with an acute posterior end, extending a little beyond the posterior border of the fin. Fins very large, thick and strong, attached nearly the entire length of the body, and together forming a broad, rhombic figure, with the outer angles behind the middle; anteriorly the attachment of the fin does not reach quite to the edge of the mantle, and the front edge forms a slightly rounded lobe in front of the attachment; posteriorly the fins are nearly united, across the back, but leave the acute, posterior tip of the body free for a short distance. The front edge of the mantle receeds in a broad curve ventrally, but has slightly prominent lateral lobes and a broad obtuse dorsal angle, which extends farther forward than the lateral does. The head is rather large, with large eyes, furnished with thin free lids. The siphon is rather large, with two small dorsal bridles. The connective cartilages on its base are rather smal, ear-shaped, such as in *Ommastrephes*. The arms are rather large, not very unequal in size, the dorsal ones slightly smaller than the others; all are unusually rounded and most of them, in our specimen, have lost their tips. They all bear two alternating rows of small prominent sharp claws, which are not very closely arranged. The inner face is not separated by a distinct margin. The tentacular arms are wanting. Color, in alcohol, orange-brown, due to nurmerous purple and brown specks scattered pretty uniformly over the surface, both above and below; the outer portions of the fins appear to have been transparent; the surface of the body appears to have been entirely smooth and destitute of tubercles, although the specimen is so much injured as to make this a little uncertain. Length of the body to front edge of mantle, 44 mm; length of free caudal portion, 6 mm; length of the attachment of fin, 34 mm; from front margin of fin to mantle edge, 3.5 mm; breadth across fins, 56 mm; length of head, from dorsal cartilage to base of dorsal arms, 19 mm; length of dorsal arms, 24 mm; diameter at base, 3.5 mm; diameter of lateral arms, 4 mm. A single mutilated specimen (No. 40,128) was taken at station 2235, 707 fathoms, 1884. This species closely resembles *A. veranyi*, recorded from the Indian Ocean, but it apparently differs from the latter by having larger fins and in being destitute of the rows of tubercles on the mantle; the arms also appear to differ in their proportions.*

DESCRIPTION.-The *mantle* is broadly conical with the tail making up approximately 14 per cent of ML in maturing adults.

The *fins* are large, their length being 71 per cent of ML while fin width equals about 91 per cent of ML.

The *head* bears large eyes whose diameter nearly equals total head length.

Figure 4-7: Drawing of *Octopoteuthis megaptera* (ventral view) showing photophore patterning. EP - eye photophore. (Scale = 10 mm)


a.
SCP
b.

The *funnel* projects about half-way along the length of the head. The dorsal pad of the funnel organ is an inverted V-shape with ridges running down each arm and a small papilla at the apex of the V.

The *arms* have hooks with accessory cusps. In a 113 mm ML female hook and sucker counts were as follows: LI - 50 hooks, 10 suckers; LIII - 53 hooks, 10 suckers; RII - 68 hooks, 12 suckers.

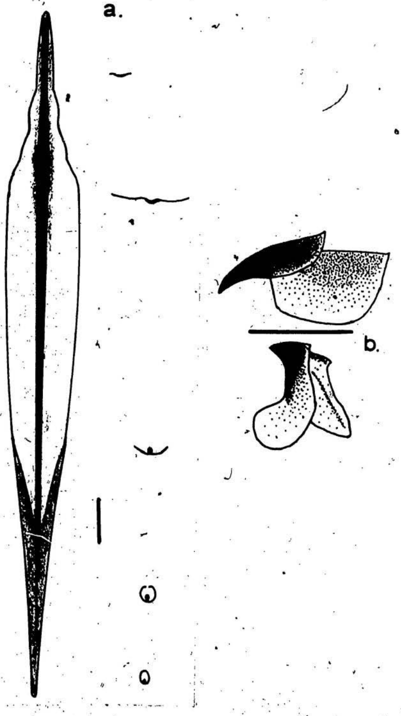
There are paired *photophores* on the ventral portion of the mantle. Paired photophores are also found adjacent to the ink sac. Single photophores are located at the anterior end of each eyelid. A crescent-shaped photophore is found on each eyeball, in an antero-dorsal position, at the junction of the iris and the sclera . These eye photophores are easily seen in specimens as small as 30 mm ML and are creamy white in colour (see Fig 4-7).

The *gladius*, like those of other species, is quite delicate (see Fig 4-8). There appears to be little or no free rachis with very narrow anterior vane extensions running right up to the anterior tip of the gladius. The RLI and the RWI of the anteriormost portion of the gladius is 11.3 and .7 percent respectively. The rachis begins to form a dorsal keel about 1/3 of the way along its length. The vanes (GWI = 9.66 percent) begin to curl ventrally about one third of the way down the gladius. The fused portion of the vanes which form the secondary conus (CLI = 7.3) do not begin until the vanes have run together for a distance equal to the conus length.

The *radula* has a tricuspid rachidian, bicuspid first lateral, and unicuspid second and third laterals. The outer cusps of the rachidian and first laterals are small. The rostrum of the lower *beak* is about 1/3 the length of the wing. The rostral edge is almost straight with a hooked tip and the jaw angle is obtuse. The upper beak has a curved rostrum and the jaw angle is slightly acute.

DISCUSSION.-Although Verrill provided good morphometric measurements

Figure 4-8: Generalized diagram of (a.) gladius (with cross sections), (b.) beaks from specimens of *Octopoteuthis megaptera*.


a.
b.

he gave no indication of the presence of photophores or the structure of the hooks of his new species. With the holotype lost there can be no way of determining these characteristics. Four identifiable species of *Octopoteuthis* occur in the Northwest Atlantic, and with the exception of Young's *O.* sp A all have been collected near the type locality of *O. megaptera*. The long standing use of the species names *sicula*, *megaptera* and *danae* and the real need to stabilize the systematics of the genus warrant retention of *megaptera* as a valid species. Since sp C, listed earlier, remains the only species of the three in the area without a name it will be designated as *megaptera*.

4.4. Octopoteuthis indica (Naef, 1923)

SYNONYMY.-

as *Octopodoteuthis indica* Naef, 1923
as *Octopoteuthis indica* Young, 1972; Clarke, 1980

Holotype: Larva, 3.8 mm ML, not located.

Type Locality: *VALDIVIA*, Sta 102, 13° 2'N, 46° 41'W, vertical net, 0-1800 m, 1898-1899.

Material Examined: Holotype not located and no additional material found.

ORIGINAL DESCRIPTION.-Translated from Naef:

"...the larva described by Chun (1910, Plate XVII, Figures 3, 4, 9) from the Agulhas Current differs from the Mediterranean specimens. The stage of development is similar but the arm apparatus is markedly less developed. There are much fewer suckers and terminal swellings are absent, even on the second pair, which is the longest. On the other hand, the tentacles are relatively strong. These are obviously two different species and I propose the name *Octopodoteuthis indica* nov. spec. for this larva. It is significant that this larva already has a buccal funnel consisting of 6 parts at a dorsal mantle length of 3.8 mm."

DISCUSSION.- The holotype of this species could not be located so character examination was limited to the brief translated description and the few illustrations in Chun's monograph. Since none of the photophore patterns or the hook structure could be determined and basing species on larval specimens is at best risky *Octopoteuthis indica* should be considered a *nomen dubium*.

4.5. Octopoteuthis persica (Naef, 1923)

SYNONYMY.-Translated from Naef:

as *Octopodoteuthis persica* **Naef, 1923**
as *Octopoteuthis persica* **Young, 1972**

Holotype: Larva, 4.7 mm ML, not located.

Type Locality: *VALDIVIA*, Sta 271, 34° 31'S 26° 0'E, vertical net, 0-1200 m, 1898-1899.

Material Examined: Holotype not traced. No additional material found.

ORIGINAL DESCRIPTION.-

"-The oldest stage described by Chun (Plate XVII, Figures 1, 2, 7, 8) probably belongs to a third species. Although it is larger and more developed, it shows no evidence of conversion of suckers into hooks. I name this form *Octopodoteuthis persica*. ...The young *O. persica* has a mantle length of only 4.7 mm, compared with 6.5 mm of the specimen of *O. sicula* described below. The fins of the specimen of *O. persica*, however, are much larger, occupying 2/3 of the mantle length and their span is more tham 1.5 times that of the mantle length. On the other hand, the arm apparatus of *O. persica* is even less developed than that of the stage described above: the third and fourth arms are still shorter than the first, and terminal swellings are only present on the second pair. All these differences are so marked that they cannot belong to the same species.

Discussion.-The specimen Naef described as a new species *persica* appears from all evidence to be a larval specimen of *Taningia danae* Joubin, 1931. Naef's description and Chun's illustration of the terminal swellings of arms II is indicative of *Taningia* and not *Octopoteuthis*. This agrees with the findings of Clarke, 1980 and Young, 1972. *O. persica* must therefore be considered a *nomen dubium*.

4.6. Octopoteuthis danae (Joubin, 1931)

SYNONYMY.-

as *Octopodoteuthis danae* Joubin, 1931
as *Octopoteuthis danae* Young, 1972; Clarke, 1980; Nesis, 1982

Holotype: Juvenile female, 32 mm ML, in good condition in Zoologisk Museum, University of Copenhagen, Copenhagen. (See Fig 4-9)

Type Locality: *DANA* Sta 1341 V, 33° 15'N, 68° 20'W, 1500 mw, S-200, 19:30, 14 May 1922

Material Examined: Holotype and additional material (See Appendices I and II).

DESCRIPTION.-The *mantle* is conical in shape and somewhat gelatinous ending in a blunt point. The mantle projects beyond the posterior portion of the fins and forms a tail averaging about 16 per cent (18.7 per cent in the holotype) of the mantle length.

The *fins* are large, rhomboidal and their length is 77 per cent (71 per cent in the holotype) of the mantle length. Their posterior ends follow along the lateral edge of the tail in the form of narrow strips while the anterior edge of the fins form free lobes.

The *head* is large with the eyes occupying almost it's total length. The olfactory papilla lies posteriorly on the head, lateral to the base of the funnel. The head is encased in a thick gelatinous layer.

The *funnel* extends nearly to the midpoint of the eyeball. The funnel locking cartilage is a modified simple straight type. The actual shape is like an elongate raindrop. The funnel organ is in three parts: a dorsal inverted V-shaped pad; and two ventral oval-shaped pads. The dorsal pad has a papilla resting on a

Figure 4-9: Photograph of the Holotype of *Octopoteuthis danae* (Joubin, 1931).

short anterior ridge. Other ridges run about halfway down each shoulder of the V. The sculpturing of the funnel organ can be highly variable. A funnel valve is present.

The *arms* are very brittle and are almost always broken distally. This makes determination of the arm formula difficult. In mature specimens they appear subequal. Larger specimens may have 50+ hooks and 6-10 suckers per arm. The hooks are alternating arranged in two rows and are enclosed in fleshy sheaths. The hooks have no accessory cusps. The distal arm tips are bare of hooks or suckers. At each arm tip there is a distinct swelling containing the subcutaneous elongate distal photophores. In the holotype only arms IV still intact. They are 19.0 and 20.0 mm long (right and left respectively). Each ventral arm bears about 45 hooks basally and approximately 9 suckers near each distal tip.

There are paired *photophores* on the ventrum of the mantle, another pair on the musculi recti abdominalis and a third pair on the ventral portion of the head near the olfactory papilla. There were no photophores on the eyeball or at the anterior of the eye orbit. There are approximately 24 photophores located along the axial nerve of each ventral arm. Photophores were found at the base of arm pairs II and III but none were found at the base of the dorsal arms. (See Fig 4-10)

The *gladius* has a short free rachis with RLI and RWI equal to 10 and 2 percent respectively. The rachis begins to form a dorsal keel about 1/3 of the way down its length. Anteriorly the vanes taper down to the rachis in a series of three gradual contractions with the final contraction before the free rachis being barely visible(see Fig 4-11). The vanes are widest at about the midpoint of the gladius (GWI = 6 percent) and begin to curl ventrally about 85 percent of the way down the gladius. The vanes do not begin to fuse until the vanes have run together for a distance greater than the conus length (CLI = 11 percent).

The *radula* has a tricuspid rachidian, bicuspid first lateral, and unicuspid

Figure 4-10: **Drawing of *Octopoteuthis danae* (Joubin, 1931) showing photophore patterning.**

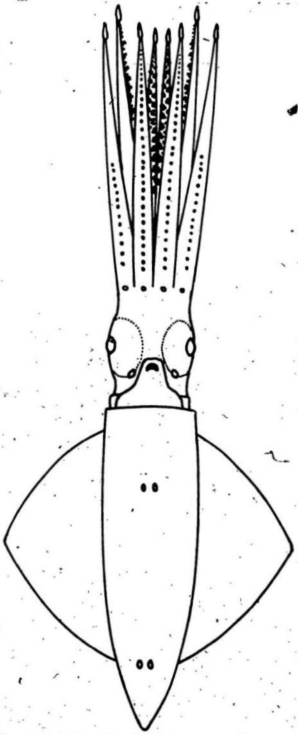
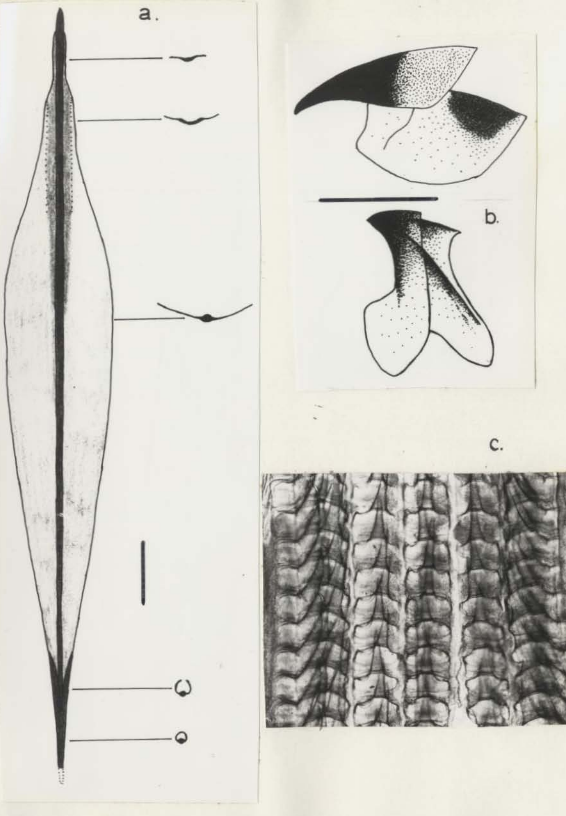


Figure 4-11: Drawings of (a.) a gladius (with cross sections), (b.) beaks and a photograph of (c.) portion of radula from specimens of *Octopoteuthis danae* (Joubin, 1931) (Scale = 10mm)


a.
b.
c.

second and third laterals. The outer cusps of the rachidian and first laterals are small. The rostrum of the lower beak is about 1/3 the length of the wing. The rostral edge is almost straight and the jaw angle is slightly obtuse. The upper beak has a curved rostrum and the jaw angle is acute.

4.7. Octopoteuthis nielseni (Robson, 1948)

SYNONYMY.-

as *Octopodoteuthis nielseni* **Robson, 1948**
as *Octopoteuthis nielseni* **Young, 1972; Clarke, 1980; Nesis, 1982**

Syntypes: Two juveniles, 26 mm ML (Robson, 1948) in extremely dehydrated condition, deposited in the British Museum (natural History), BM 1947.7.7.10.

Type Locality: *ARCTURUS*, Sta 74, 4° 50'N, 87° 00'W, near Cocos Island, Pacific Ocean, 0-727 and 0-909 m, open tow net, 14:30, 2 June 1925.

Material Examined.- Syntypes.

ORIGINAL DESCRIPTION.-

"Dorsal length of mantle ...... 26 (?+) mm
Maximum width of mantle ....12+mm,
Maximum length of fins 22mm
Total width of fins 34mm
Length of head (mantle edge to base of dorsal arms.................9mm
Width of head 11mm
Length of third arms ....36+mm

In *O. nielseni* the suckers and hooks are arranged in a zig-zag about the median furrow. So much damage has been done to the arms that it is not easy to say how many hooks there were. On one arm there are at least 20 pairs.

The hooks are, as in *sicula*, sheathed in fleshy casings and are upright and columnar. The fins are 84% of the body-length and their total span is 130% of the mantle-length (both figures are the same as in *sicula*). The cephalic component of the adhesive-organ is not like that of *sicula* as shown in Pfeffer's fig. 9, pl. 12 (1912); there is a far wider and less distinctly channelled groove. Unlike those of *sicula* the arms are rounded and have neither the "Schwimmsaume" nor the "Schutzsaume." ... The funnel organ is not like that of *sicula* figured by Jatta (1896) though it is a little more like that shown by Sasaki (1929). The radula is quite unlike that of *sicula* (Jatta, 1896, pl. 13, fig. 8) in its rhachidian tooth, with an extraordinary small base and square admedian tooth.

...The general shape and the form of the fins are not particularly different from those of *sicula* (e.g. as given by Pfeffer and Sasaki). The adhesive-organ, radula and the entire lack of membranes on the arms (which cannot be due to damage) are, however, features which preclude our ranking it with *sicula*. The adhesive organ is of uncertain importance. Another point of diagnostic value is the great length of the third arms.

sicula. Jatta. Longest arms 25 mm. Pfeffer. Longest arms equal mantle. Sasaki. Longest arms slightly shorter than mantle.

nielseni. Longest arms 36 mm., mantle 26 mm.

DISCUSSION.- The syntypes were borrowed from the British Museum (natural History) but were so severely dehydrated that no measurements or meristics could possibly be taken. The lack of knowledge about the photophore patterns and hook configuration of the syntypes inhibits any attempt to validate the species. The species C listed above has been assigned to *Octopoteuthis megaptera* but appears to be found circum-globally. Future comparison of Atlantic and East Indian Ocean/West Pacific material may discern enough difference in characteristics to separate species C into two species the Pacific one being *nielseni*. Until that time *nielseni* must be considered a *nomen dubium*.

4.8. Octopoteuthis longiptera (Akimushkin, 1963)

SYNONYMY.-

as *Octopodoteuthis longiptera* **Akimushkin, 1963**
as *Octopoteuthis longiptera* **Young, 1972; Clarke, 1980; Nesis, 1982**

Holotype: Adult, 590 mm ML, not extant (K. N. Nesis, personal communication).

Type Locality: From Sperm whale stomach, 20 ° S, 25 ° W.

Material Examined: None available.

DESCRIPTION.-Akimushkin's original description is as follows.
" ...head and arms had traces of a jellylike tissue which apparently covered the body of the live animal and had been partially digested.

Mantle, conical, 3 times as long as wide (c/l=33%). Dorsal margin of mantle protruding markedly forward to form an acute angle. Ventral incision inconspicuous. Fins long, extending from anterior margin of mantle (excluding the dorsal protuberance) along entire lateral surface to posterior end of mantle, where they narrow markedly to form a narrow border. Fins oval with the longer axis situated along the body, 36% longer than wide, 92% of the mantle length measured with the dorsal protuberance.

Head large but narrower than the mantle (o/c=70%). Eyes very large, convex but not stalked. Nuchal folds absent. Tuberculus olfactorius fairly long but thin and inconspicuous. Infundibular funnel of medium depth.

Funnel very long, terminally protruding beyond anterior margin of eyeball, though the eyes of this species are not small. Infundibular cartilage large, subtriangular, with narrow anterior and wide, obtuse posterior end. Central pit of infundibular cartilage deep, wide, pyriform.

Buccal membrane with 6 apexes and 7 rays. Two dorsal pairs of buccal darts attached dorsad to suckers of corresponding arms, two ventral ones - ventrad.

Arms of medium length (l/L=47%). The tips of all but the second and third arms had been cut off, so their length is unknown. The second, however, is much longer than the third. Swimming carinae destroyed or absent. Fragments of protective membrane show that these were well developed on the base of the arms (where they covered the hooks completely) and probably had an undulate margin. All arms bear two dense rows of large hooks. Terminally the hooks diminish in size and the rows fuse into one zigzag line. Terminal part (7-8%) of arms covered with minute suckers disposed at first in a straight row but as the arm widens form a zigzag pattern and terminally reappear in a straight row. The terminal swellings of the arms, typical of the genus *Octopodoteuthis*, are almost imperceptible in our specimen; on the other hand, the tips of the preserved arms are somewhat compressed laterally.

Tentacles totally absent, without even a trace of their site of attachment. Beak with ventral mandible of highly characteristic form. Total length of specimen 590 mm."

DISCUSSION.-ALthough Akimushkin described the largest *Octopoteuthis* specimen ever recorded in the literature the diagnosis of his new species lacked any good characters to separate his species with any others. Coupled with the fact that the holotype is no longer extant this species must be considered a *nomen dubium*. This agrees with the observations of Young, 1972; Clarke, 1980 and even Nesis, 1982.

4.9. Octopoteuthis deletron Young, 1972

SYNONYMY.-

as *Octopoteuthis deletron* Young, 1972
as *Octopoteuthis sicula* Pearcy, 1965; Okutani and McGowan, 1969

Holotype: Male, 109 mm ML, extant and in good condition, deposited in the Allan Hancock Foundation, Los Angeles, California, Catalogue No. C-type#3.

Type Locality: *VELERO*, Sta 8716, 33° 15'N, 118° 37'W, 950 mw, IKMT, 7 June 1963.

Material Examined: Holotype and one paratype plus additional material. (See Appendices I and II)

DESCRIPTION.-The holotype of *O. deletron* is in the best condition of any of the existing species types (see Fig 4-12). It is a maturing male (100 mm ML) with several complete arms. The holotype has undergone some shrinkage (10-15 per cent) in most body measurements (see Table 4-1).

Table 4-1: Variation in body measurements in the holotype of *Octopoteuthis deletron* after 15 years of preservation.

BODY LENGTH	PRESENT MEASUREMENT (mm)	ORIGINAL MEASUREMENT (Young, 1972) (mm)
ML	100.0	109.0
MW	30.0	37.0
FL	80.0	94.0
FW	96.0	104.0
HW	29.3	33.0
T1L	8.0	13.0

The *mantle* is conical with the posterior apex appearing very blunt due to ventral curving of the tail. The tail averages about 16 per cent of the mantle length in adults (8 per cent in the holotype).

The *fins* are large as in other species. Posteriorly, they appear to end short of the mantle but actually continue as reduced narrow strips along each lateral edge of the tail. The fin length averages 75.6 per cent (80 per cent in the holotype) of the mantle length.

The *head* is fairly large and the eyes extend almost the entire length of the head.

The *funnel* is fairly long extending almost to the midpoint of the head. The funnel lockingcartilage is a modified simple straight form which posteriorly curves slightly and flares.. As in other *Octopoteuthis* species, the dorsal pad of the funnel organ is an inverted V-shape with short ridges on the arms and a prominent papilla on a ridge at the apex. The ventral pads of the organ are oval.

There are two complete *arms* in the holotype, the ventral right (IV) and the ventral-lateral left (III). The second right arm (II) is regenerating but this will be discussed in a later section. Each arm has gelatinous aboral keels. The arms bear two rows of small hooks protected by fleshy sheaths. There are two distinct, small accessory .cusps on, each hook. There are 3-11 small suckers at the distal end of each arms (just before the distal elongate photophore).

There is a single *photophore* on the ventrum of the mantle (a character shared with only one other *Octopoteuthis* species). Paired photophores are found lying ventrally on the ink sac, and two ventrally, one, on each side of the of the head near the olfactory papillae. Single photophores are found near the anterior medial margin of each eye and are obliquely orientated. The third and fourth arm pairs each have a series of photophores lying near the axial nerve. The basal photophore in each series is larger than those following it and is somewhat isolated from the others. In the holotype the arms IV bear about 25 photophores and arms III bear about 2 photophores. Arms II bear just the basal photophore while arms I lack any of the series. All four arm pairs bear the distal elongate photophores. (See Fig 4-13)

The *gladius* has a short free rachis with RLI and RWI equal to 4.6 and 1.6 percent respectively (see Fig 4-14). The rachis begins to form a dorsal keel about 1/3 of the way down its length. Anteriorly the vanes taper down to the rachis in a series of three gradual contractions with the final contraction before the free

Figure 4-12: Photograph of the Holotype of *Octopoteuthis deletron* Young, 1972.

Figure 4-13: Drawing of *Octopoteuthis deletron* Young, 1972 showing photophore patterning. (Scale = 10mm)

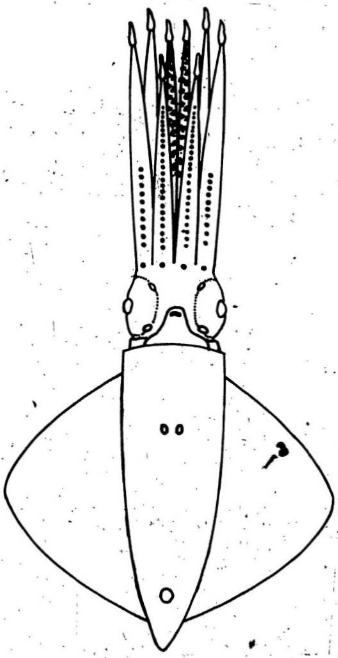
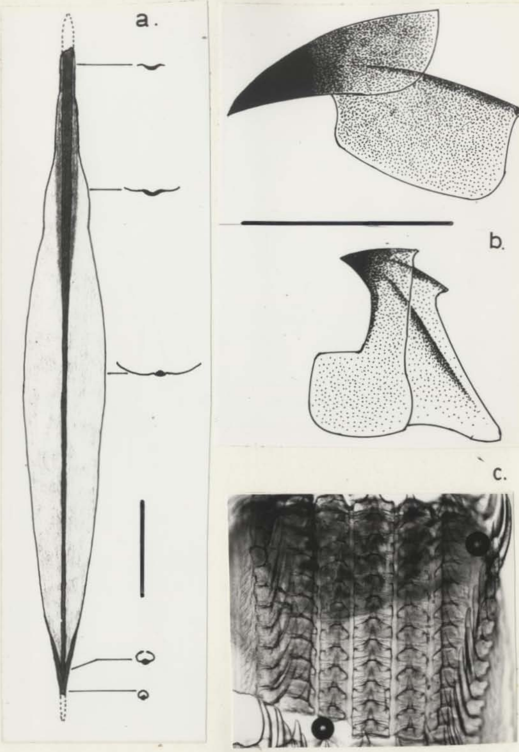


Figure 4-14: Drawings of (a.) a gladius (with cross sections), (b.) beaks and photograph of (c.) portion of radula from specimens of *Octopoteuthis deletron* Young, 1972 (Scale = 10mm)


a.
b.
c.

rachis being barely visible. The vanes are widest about halfway down the gladius (GWI = 6.9 percent) and begin to curl ventrally about 85 percent of the way down the gladius. The vanes do not begin to fuse until the vanes have run together for a distance greater than the conus length (CLI = 5 percent).

The *radula* has a tricuspid rachidian, bicuspid first lateral, and unicuspid second and third laterals. The outer cusps of the rachidian and first laterals are small. The rostrum of the lower *beak* is about 1/3 the length of the wing. The rostral edge is almost straight with a hooked tip and the jaw angle is obtuse. The upper beak has a curved rostrum and the jaw angle is acute.

4.10. Octopoteuthis rugosa Clarke, 1980

SYNONYMY.-

as *Octopoteuthis rugosa* Clarke, 1980, Nesis, 1982; Toll, 1982; Roper, Sweeney, and Clarke, 1985

Holotype: Mature female, 160 mm ML, in fair condition in the British Museum (natural History), BM 1973.100. Three paratypes also extant.

Type Locality: From sperm whale stomach, Donkergat, South Africa, 29 September 1963.

Material Examined: The holotype and a paratype (see Appendices I and II)

DESCRIPTION.-The holotype and a paratype of *Octopoteuthis rugosa* were examined. The holotype is a large mature female (see Fig 4-15) and the paratype is a male, both collected from a whale stomach.

The *mantle* is large and conical, tapering posteriorly into a large tail. Although there is a considerable amount of digestion of the outer epithelium, the structure of the mantle can still be determined. There is found, both at the anterior and the posterior ends of the mantle, an outer gelatinous covering. In

Figure 4-15: Photograph of the holotype of *Octopoteuthis rugosa* Clarke, 1980 (arrows = 15 mm).

the holotype, the gelatinous layer at the anterior end bears longitudinal grooves. The rugose *mantle*, for which the species was named, is a secondary sex character, as Clarke suspected. It is found in all fully mature female *Octopoteuthis* and is not species specific.

The *fins* are about 80 per cent of the ML in the holotype and 85 per cent in the paratype. The posterior end of the fins forms small lateral ridges on the tail of each specimen. The tail makes up about 16 per cent of the ML.

The *head* is large, with the eye diameter nearly equal to head length.

The *funnel* reaches nearly to the midpoint of the eye. The funnel locking cartilage is simple and straight but modified so that the posterior portion flares out slightly. The funnel organ has been dissolved in both specimens so that distinguishing characters have been obliterated.

There are only two intact *arms* in the holotype (arms III) and one in the paratype (right arm IV). Almost all of the hooks and suckers were lost from the arms so no accurate count could be taken.

In Clarke's (1980) description of his new species *O. rugosa* he expressly stated that he could find no *photophores*. Careful examination of both the holotype and the paratype revealed a number of photophores on both (although neither animal bore a complete set). There are paired photophores on the posterio-ventral side of both mantles (see Fig 4-16 for those of the female holotype), a pair of photophores on the recti abdominis muscles of the male, and eye orbit photophores on both. There were 12 photophores located along the axial nerves of arms III of the holotype and about 40 in the arms IV of the paratype. The condition of all but a few of these photophores was admittedly very poor but they are clearly demonstrable. It is not surprising that these organs, obviously missed by Clarke (1980), are in poor shape since these specimens were secured after having undergone partial digestion in a sperm whale stomach.

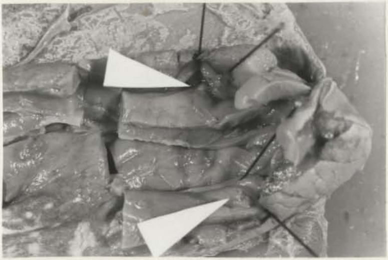


Figure 4-16: Photograph of the posterior ventral portion of the mantle of the holotype of *Octopoteuthis rugosa* Clarke, 1980 showing the paired photophores (arrows = 15 mm).

DISCUSSION.-Clarke separates *rugosa* from other *Octopoteuthis* species by (1) lack of photophores on the mantle wall and ink sac, (2)a rugose mantle in females and (3)lateral pigment bands on the ventral arms (first described in *O. deletron* by Young in 1972 is common to all species). Examination of Clarke's specimens show that photophores are present. The rugose mantle is found in all sexually mature female *Octopoteuthis* and the lateral pigment bands are present in all species. Thus there appear to be no characters by which *rugosa* can be identified as a distinct species and, as a result, it should be considered a *nomen dubium*.

4.11. Octopoteuthis sp A

DESCRIPTION.-Young (1972) first used this designation for a species of *Octopoteuthis* found in the Atlantic that, like his *O. deletron*, bore a single ventral abdominal photophore on the mantle. (See Fig 4-17)

The *mantle* is conical with the tail portion averaging about 15 per cent of total mantle length. Like the other species of the genus, the mantle bears a gelatinous outer layer.

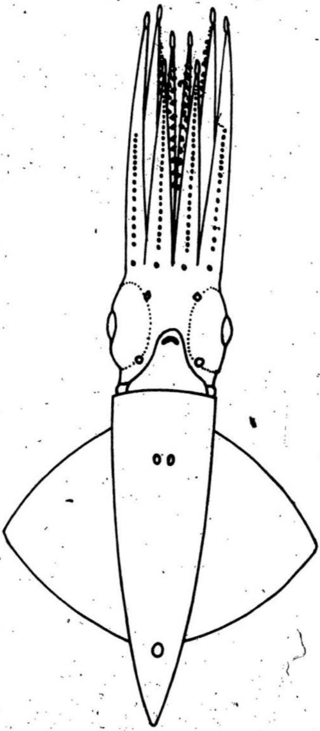
The *fins* are large and muscular, their length 77 per cent and their width about 104 per cent of ML.

The *head* is large (37 per cent of ML) with the eye diameter almost equal to it's total length.

The *funnel* is relatively long, reaching nearly to the midpoint of the head. The inverted V-shaped dorsal pad of the funnel organ is, as in other species, highly variable in form. It generally has a small papilla on the apex of the dorsal pad with small to high ridges running down each arm.

The *arms* have hooks (65-70 per arm in an 84 mm ML specimen) which lack accessory cusps. The arms also bear several small pairs of suckers distally (7-10 in an 84 mm ML specimen).

Figure 4-17: Drawing of Young's *Octopoteuthis* sp A showing photophore patterning.



There is a single *photophore* found ventrally on the posterior portion of the mantle. As in all species there are paired photophores lying ventrally adjacent to the ink sac and at the posterior portion of the eye orbit. There is also a pair of anterior eyeball photophores as in *O. deletron*. These eyeball photophores are almost square. There are serial photophores along arms III and IV.

The *gladius* is fragile with the free portion of the rachis (RLI =13.6 percent) being wider (RWI = 3 percent) than in other *Octopoteuthis* species. The vanes (GWI = 6.6 percent) are very thin and appear to taper posteriorly. In effect the two vanes begin to curl ventrally about two-thirds of the way down the gladius until they touch and fuse, forming a long secondary conus (CLI = 15.9 percent), posteriorly. (See Fig 4-18)

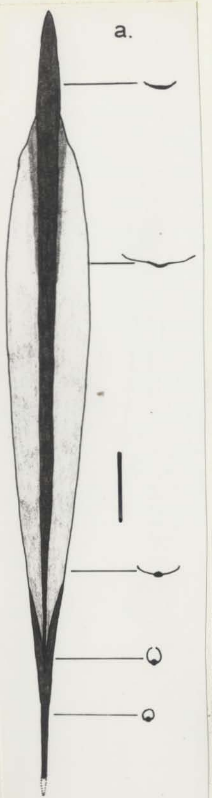
The *radula* has a tricuspid rachidian, bicuspid first lateral, and unicuspid second and third laterals. The outer cusps of the rachidian and first laterals are small as in other species. The rostrum of the lower *beak* is about 1/3 the length of the wing. The rostral edge is almost straight with a hooked tip and the jaw angle is almost ninety degrees. The upper beak has a slightly curved rostrum and the jaw angle is acute.

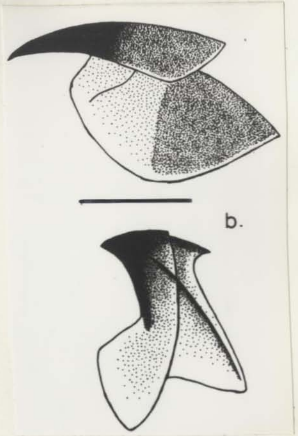
4.12. Statistical Analysis of Morphometric Data

The summary of indices for each species are presented below in a series of tables 4-3 to 4-7. Each index is handled in 25 mm ML intervals for the entire size range available for each species. Larval indices (see Table 4-2) are handled in 5 mm ML intervals although they cannot yet be identified to species. The arm length indices and the tentacular length indices are not presented for the individual species because of the very high percentage of loss of arms and total loss of tentacles in juveniles and adults.

The means comparisons of each variable gave an indication of differences between species presented in tables 4-8 through 4-15.

Figure 4-18: Drawings of (a.) gladius (with cross sections), (b.) beaks and photograph of (c.) portion of radula from specimens of *Octopoteuthis* sp A (Scale = 10mm)





c.

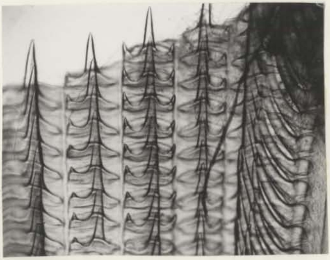


Table 4-2: Summary of indices for selected 5 mm increment series of *Octopoteuthis* spp larvae.

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
ML = 6-10 mm						
MWI	35	0.48	0.26	0.69	0.01	0.09
FLI	73	0.68	0.00	1.33	0.02	0.18
FWI	67	1.41	0.29	2.56	0.04	0.36
HLI	38	0.48	0.34	0.65	0.01	0.08
HWI	34	0.57	0.40	0.69	0.01	0.08
TILI	73	0.00	0.00	0.21	0.00	0.03
EDI	35	0.20	0.06	0.33	0.01	0.04
LDI	33	0.07	0.04	0.10	0.00	0.01
TtLI	13	0.56	0.35	0.77	0.04	0.13
TLI	12	2.06	1.69	2.70	0.08	0.26
ALI I	73	0.02	0.00	0.78	0.01	0.12
ALI II	2	1.08	1.02	1.14	0.06	0.09
ALI III	2	0.93	0.88	0.98	0.05	0.07
ALI IV	2	0.50	0.45	0.55	0.05	0.07
ML = 11-15 mm						
MWI	16	0.41	0.30	0.50	0.01	0.06
FLI	25	0.78	0.58	1.25	0.03	0.13
FWI	25	1.29	0.46	2.00	0.06	0.32
HLI	16	0.41	0.30	0.53	0.02	0.07
HWI	16	0.48	0.39	0.55	0.01	0.05
TILI	25	0.02	0.00	0.14	0.01	0.04
EDI	16	0.18	0.10	0.25	0.01	0.04
LDI	16	0.06	0.04	0.09	0.00	0.01
TtLI	0	.	.	.	.	.
TLI	9	1.95	0.25	2.51	0.23	0.69
ALI I	25	0.08	0.00	0.72	0.05	0.23
ALI II	3	1.06	0.93	1.12	0.06	0.11
ALI III	6	0.78	0.83	0.93	0.05	0.12
ALI IV	6	0.63	0.08	0.79	0.11	0.28
ML = 16-20 mm						
MWI	9	0.39	0.31	0.51	0.02	0.06
FLI	15	0.77	0.42	1.06	0.03	0.13
FWI	15	1.33	0.59	1.76	0.06	0.25
HLI	10	0.38	0.27	0.45	0.02	0.05
HWI	10	0.41	0.26	0.50	0.02	0.07
TILI	15	0.05	0.00	0.19	0.01	0.06
EDI	10	0.19	0.15	0.25	0.01	0.03
LDI	10	0.06	0.04	0.08	0.00	0.01
TtLI	0	.	.	.	.	.
TLI	5	2.22	2.07	2.44	0.06	0.14
ALI I	15	0.18	0.00	0.79	0.08	0.31
ALI II	2	0.83	0.78	0.87	0.05	0.07
ALI III	2	0.67	0.67	0.68	0.00	0.01
ALI IV	3	0.54	0.49	0.60	0.03	0.05

Table4-2, continued

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
ML = 21-25 mm						
MWI	3	0.31	0.23	0.38	0.05	0.08
FLI	4	0.64	0.37	0.76	0.09	0.18
FWI	4	1.16	0.74	1.40	0.14	0.29
HLI	3	0.32	0.23	0.36	0.04	0.08
HWI	3	0.35	0.26	0.41	0.05	0.08
TiLI	4	0.05	0.00	0.12	0.03	0.06
EDI	3	0.17	0.10	0.21	0.04	0.06
LDI	3	0.05	0.04	0.06	0.01	0.01
TtLI	0	.	.	.	.	.
TLI	3	1.93	1.63	2.21	0.17	0.29
ALI I	4	0.34	0.00	0.69	0.19	0.39
ALI II	2	0.81	0.71	0.90	0.09	0.13
ALI III	1	0.40	0.40	0.40	.	.
ALI IV	2	0.56	0.53	0.59	0.03	0.04

Table 4-3: Summary of indices for selected series *Octopoteuthis sicula* representing the entire size range available.

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
			ML = 25-50 mm			
MWI	25	0.33	0.25	0.44	0.01	0.05
FLI	31	0.73	0.61	0.89	0.01	0.06
FWI	31	1.20	1.04	1.45	0.02	0.11
HLI	25	0.43	0.26	0.55	0.01	0.06
HWI	25	0.36	0.27	0.49	0.01	0.05
TILI	31	0.13	0.08	0.18	0.00	0.03
EDI	25	0.23	0.14	0.32	0.01	0.04
LDI	24	0.08	0.04	0.11	0.00	0.02
			ML = 51-75 mm			
MWI	7	0.29	0.27	0.31	0.01	0.02
FLI	10	0.76	0.71	0.84	0.01	0.04
FWI	10	1.12	1.00	1.30	0.03	0.09
HLI	7	0.40	0.35	0.49	0.02	0.05
HWI	7	0.34	0.27	0.38	0.01	0.04
TILI	10	0.18	0.10	0.31	0.02	0.07
EDI	7	0.25	0.22	0.27	0.01	0.02
LDI	7	0.09	0.07	0.10	0.00	0.01
			ML = 76-100 mm			
MWI	5	0.32	0.26	0.39	0.02	0.05
FLI	6	0.81	0.71	0.95	0.04	0.11
FWI	6	1.13	1.00	1.34	0.05	0.13
HLI	6	0.35	0.32	0.40	0.01	0.03
HWI	5	0.32	0.25	0.39	0.03	0.06
TILI	6	0.14	0.00	0.23	0.03	0.08
EDI	6	0.25	0.23	0.28	0.01	0.02
LDI	5	0.08	0.08	0.09	0.00	0.01
			ML = 101-125 mm			
MWI	4	0.26	0.22	0.30	0.02	0.04
FLI	12	0.75	0.64	0.85	0.02	0.06
FWI	12	0.99	0.90	1.15	0.02	0.07
HLI	5	0.29	0.27	0.35	0.01	0.03
HWI	5	0.27	0.22	0.30	0.01	0.03
TILI	12	0.16	0.09	0.23	0.01	0.04
EDI	5	0.21	0.18	0.22	0.01	0.02
LDI	5	0.07	0.07	0.07	0.00	0.00
			ML = 126-150 mm			
MWI	2	0.28	0.23	0.33	0.05	0.07
FLI	3	0.77	0.73	0.84	0.04	0.06
FWI	3	1.00	0.92	1.08	0.04	0.08
HLI	2	0.28	0.27	0.29	0.01	0.01
HWI	2	0.26	0.23	0.28	0.03	0.04
TILI	3	0.12	0.00	0.20	0.06	0.11
EDI	2	0.20	0.19	0.21	0.01	0.01
LDI	2	0.07	0.07	0.07	0.00	0.00

Table4-3, continued

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
ML = 151-175 mm						
MWI	0	.	.	.	.	.
FLI	1	0.81	0.81	0.81	.	.
FWI	1	1.03	1.03	1.03	.	.
HLI	0	.	.	.	.	.
HWI	0	.	.	.	.	.
TILI	1	0.15	0.15	0.15	.	.
EDI	0	.	.	.	.	.
LDI	0	.	.	.	.	.
ML = 176-200 mm						
MWI	0	.	.	.	.	.
FLI	2	0.80	0.79	0.82	0.02	0.02
FWI	2	0.98	0.92	1.03	0.05	0.07
HLI	0	.	.	.	.	.
HWI	0	.	.	.	.	.
TILI	2	0.19	0.17	0.22	0.03	0.04
EDI	0	.	.	.	.	.
LDI	0	.	.	.	.	.
ML = 201-225 mm						
MWI	1	0.25	0.25	0.25	.	.
FLI	1	0.75	0.75	0.75	.	.
FWI	1	0.87	0.87	0.87	.	.
HLI	1	0.29	0.29	0.29	.	.
HWI	1	0.24	0.24	0.24	.	.
TILI	1	0.22	0.22	0.22	.	.
EDI	1	0.14	0.14	0.14	.	.
LDI	1	0.06	0.06	0.06	.	.

Table 4-4: Summary of indices for selected series of *Octopoteuthis megaptera* representing the entire size range available.

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
			ML = 25-50 mm			
MWI	27	0.32	0.26	0.38	0.01	0.04
FLI	35	0.72	0.65	0.86	0.01	0.05
FWI	35	1.12	0.74	1.33	0.02	0.11
HLI	26	0.43	0.29	0.71	0.02	0.09
HWI	27	0.34	0.22	0.41	0.01	0.04
T1LI	35	0.16	0.00	0.28	0.01	0.05
EDI	27	0.23	0.09	0.33	0.01	0.05
LDI	25	0.07	0.02	0.11	0.00	0.02
			ML = 51-75 mm			
MWI	10	0.30	0.23	0.36	0.01	0.04
FLI	11	0.71	0.62	0.78	0.01	0.05
FWI	11	1.02	0.84	1.22	0.03	0.10
HLI	10	0.39	0.31	0.48	0.02	0.06
HWI	10	0.32	0.26	0.38	0.01	0.04
T1LI	11	0.19	0.06	0.26	0.02	0.06
EDI	10	0.25	0.20	0.31	0.01	0.04
LDI	10	0.08	0.05	0.10	0.00	0.01
			ML = 76-100 mm			
MWI	11	0.28	0.24	0.33	0.01	0.03
FLI	13	0.72	0.63	0.77	0.01	0.04
FWI	12	0.95	0.88	1.05	0.02	0.06
HLI	11	0.37	0.31	0.43	0.01	0.04
HWI	11	0.29	0.21	[illegible]	0.02	0.05
T1LI	13	0.21	0.15	0.29	0.01	0.04
EDI	11	0.24	0.18	0.27	0.01	0.03
LDI	11	0.08	0.06	0.09	0.00	0.01
			ML = 101-125 mm			
MWI	7	0.31	0.20	0.69	0.06	0.17
FLI	12	0.68	0.60	0.76	0.01	0.05
FWI	12	0.91	0.77	1.04	0.02	0.08
HLI	7	0.35	0.27	0.40	0.02	0.05
HWI	7	0.27	0.22	0.35	0.02	0.04
T1LI	12	0.22	0.13	0.29	0.01	0.04
EDI	8	0.20	0.18	0.23	0.01	0.02
LDI	8	0.06	0.06	0.07	0.00	0.01
			ML = 126-150 mm			
MWI	5	0.27	0.21	0.30	0.02	0.04
FLI	8	0.73	0.67	0.85	0.02	0.05
FWI	6	0.95	0.88	1.00	0.02	0.05
HLI	5	0.32	0.24	0.38	0.02	0.05
HWI	5	0.24	0.20	0.26	0.01	0.02
T1LI	8	0.19	0.12	0.26	0.02	0.05
EDI	5	0.18	0.16	0.20	0.01	0.02
LDI	5	0.06	0.04	0.08	0.01	0.01

Table4-4, continued

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
ML = 151-175 mm						
MWI	3	0.25	0.22	0.28	0.02	0.03
FLI	5	0.71	0.66	0.79	0.02	0.06
FWI	5	0.87	0.78	1.00	0.04	0.09
HLI	3	0.29	0.27	0.33	0.02	0.03
HWI	3	0.24	0.23	0.25	0.01	0.01
TILI	5	0.22	0.14	0.26	0.02	0.05
EDI	3	0.13	0.06	0.18	0.04	0.07
LDI	3	0.06	0.06	0.07	0.00	0.01
ML = 176-200 mm						
MWI	1	0.24	0.24	0.24	.	.
FLI	1	0.64	0.64	0.64	.	.
FWI	1	0.81	0.81	0.81	.	.
HLI	1	0.33	0.33	0.33	.	.
HWI	1	0.21	0.21	0.21	.	.
TILI	1	0.25	0.25	0.25	.	.
EDI	1	0.16	0.16	0.16	.	.
LDI	1	0.06	0.06	0.06	.	.

Table 4-5: Summary of indices for selected series of *Octopoteuthis danae* (Joubin, 1931) representing the entire size range available.

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
ML = 25-50 mm						
MWI	7	0.34	0.31	0.36	0.01	0.02
FLI	10	0.74	0.63	0.81	0.02	0.05
FWI	10	1.25	1.09	1.49	0.03	0.10
HLI	7	0.43	0.39	0.49	0.01	0.04
HWI	7	0.38	0.36	0.41	0.01	0.02
TILI	10	0.12	0.00	0.23	0.03	0.09
EDI	7	0.25	0.21	0.30	0.01	0.03
LDI	6	0.09	0.08	0.11	0.00	0.01
ML = 51-75 mm						
MWI	12	0.33	0.22	0.40	0.01	0.05
FLI	18	0.79	0.67	1.09	0.03	0.11
FWI	18	1.12	1.02	1.25	0.01	0.06
HLI	14	0.35	0.32	0.42	0.01	0.03
HWI	11	0.35	0.28	0.50	0.02	0.07
TILI	18	0.14	0.00	0.23	0.02	0.07
EDI	13	0.24	0.22	0.30	0.01	0.02
LDI	13	0.09	0.08	0.10	0.00	0.01
ML = 76-100 mm						
MWI	2	0.31	0.29	0.33	0.02	0.03
FLI	2	0.70	0.69	0.71	0.01	0.01
FWI	2	1.05	1.02	1.08	0.03	0.04
HLI	2	0.32	0.30	0.34	0.02	0.02
HWI	2	0.36	0.33	0.38	0.03	0.04
TILI	2	0.16	0.12	0.21	0.05	0.06
EDI	2	0.23	0.22	0.24	0.01	0.02
LDI	2	0.09	0.08	0.09	0.00	0.00
ML = 101-125 mm						
MWI	1	0.25	0.25	0.25	.	.
FLI	2	0.83	0.74	0.92	0.09	0.13
FWI	2	1.09	0.95	1.22	0.14	0.19
HLI	1	0.31	0.31	0.31	.	.
HWI	1	0.24	0.24	0.24	.	.
TILI	2	0.09	0.00	0.18	0.09	0.12
EDI	1	0.21	0.21	0.21	.	.
LDI	1	0.08	0.08	0.08	.	.

Table 4-6: Summary of indices for selected series of *Octopoteuthis deletron* Young, 1972 representing the entire size range available.

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
			ML = 25-50 mm			
MWI	3	0.31	0.28	0.33	0.02	0.03
FLI	14	0.79	0.72	0.94	0.02	0.06
FWI	14	1.19	1.09	1.30	0.02	0.06
HLI	3	0.37	0.26	0.43	0.06	0.10
HWI	3	0.31	0.29	0.33	0.01	0.02
TILI	14	0.07	0.00	0.15	0.01	0.05
EDI	3	0.24	0.21	0.28	0.02	0.03
LDI	3	0.08	0.07	0.09	0.01	0.01
			ML = 51-75 mm			
MWI	2	0.34	0.33	0.35	0.01	0.01
FLI	4	0.74	0.69	0.82	0.03	0.06
FWI	4	1.14	1.06	1.25	0.04	0.08
HLI	2	0.33	0.32	0.35	0.02	0.03
HWI	2	0.32	0.24	0.41	0.08	0.12
TILI	4	0.11	0.07	0.17	0.02	0.04
EDI	1	0.26	0.26	0.26	.	.
LDI	1	0.09	0.09	0.09	.	.
			ML = 76-100 mm			
MWI	3	0.30	0.26	0.33	0.02	0.04
FLI	3	0.81	0.80	0.82	0.01	0.01
FWI	3	1.01	0.96	1.05	0.03	0.05
HLI	3	0.32	0.23	0.39	0.05	0.08
HWI	3	0.30	0.28	0.34	0.02	0.03
TILI	3	0.08	0.06	0.08	0.01	0.01
EDI	3	0.21	0.20	0.22	0.01	0.01
LDI	3	0.08	0.07	0.08	0.00	0.01
			ML = 101-125 mm			
MWI	1	0.27	0.27	0.27	.	.
FLI	1	0.71	0.71	0.71	.	.
FWI	1	1.07	1.07	1.07	.	.
HLI	1	0.30	0.30	0.30	.	.
HWI	1	0.28	0.28	0.28	.	.
TILI	1	0.17	0.17	0.17	.	.
EDI	1	0.22	0.22	0.22	.	.
LDI	1	0.08	0.08	0.08	.	.
			ML = 126-150 mm			
MWI	0	.	.	.	.	.
FLI	3	0.76	0.73	0.81	0.03	0.04
FWI	3	0.86	0.83	0.89	0.02	0.03
HLI	0	.	.	.	.	.
HWI	0	.	.	.	.	.
TILI	3	0.18	0.16	0.23	0.02	0.04
EDI	0	.	.	.	.	.
LDI	0	.	.	.	.	.

Table4-6, continued

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
ML = 151-175 mm						
MWI	0	.	.	.	.	.
FLI	1	0.76	0.76	0.76	.	.
FWI	1	0.88	0.88	0.88	.	.
HLI	0	.	.	.	.	.
HWI	0	.	.	.	.	.
TILI	1	0.16	0.16	0.16	.	.
EDI	0	.	.	.	.	.
LDI	0	.	.	.	.	.
ML = 176-200 mm						
MWI	1	0.27	0.27	0.27	.	.
FLI	1	0.69	0.69	0.69	.	.
FWI	1	0.84	0.84	0.84	.	.
HLI	1	0.21	0.21	0.21	.	.
HWI	1	0.27	0.27	0.27	.	.
TILI	1	0.16	0.16	0.16	.	.
EDI	1	0.15	0.15	0.15	.	.
LDI	1	0.06	0.06	0.06	.	.

Table 4-7: Summary of indices for selected series of *Octopoteuthis* sp A Young, 1972 representing the entire size range available.

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
			ML 25-50 mm			
MWI	1	0.27	0.27	0.27	.	.
FLI	1	0.87	0.87	0.87	.	.
FWI	1	1.26	1.26	1.26	.	.
HLI	1	0.52	0.52	0.52	.	.
HWI	1	0.32	0.32	0.32	.	.
TILI	1	0.19	0.19	0.19	.	.
EDI	1	0.24	0.24	0.24	.	.
LDI	1	0.07	0.07	0.07	.	.
			ML 51-75 mm			
MWI	2	0.28	0.26	0.30	0.02	0.03
FLI	3	0.76	0.70	0.83	0.04	0.07
FWI	3	1.11	0.99	1.30	0.10	0.17
HLI	2	0.42	0.41	0.43	0.01	0.01
HWI	2	0.29	0.25	0.33	0.04	0.06
TILI	3	0.15	0.11	0.21	0.03	0.05
EDI	2	0.22	0.21	0.23	0.01	0.01
LDI	2	0.07	0.07	0.07	0.00	0.00
			ML 76-100 mm			
MWI	0	.	.	.	.	.
FLI	4	0.76	0.69	0.86	0.04	0.07
FWI	4	1.00	0.88	1.10	0.04	0.09
HLI	0	.	.	.	.	.
HWI	0	.	.	.	.	.
TILI	4	0.15	0.08	0.20	0.03	0.05
EDI	0	.	.	.	.	.
LDI	0	.	.	.	.	.
			ML 101-125 mm			
MWI	2	0.28	0.24	0.31	0.03	0.05
FLI	3	0.71	0.69	0.76	0.02	0.04
FWI	3	0.91	0.85	0.95	0.03	0.05
HLI	2	0.38	0.35	0.41	0.03	0.04
HWI	2	0.32	0.26	0.38	0.06	0.08
TILI	3	0.20	0.15	0.24	0.03	0.05
EDI	2	0.25	0.24	0.26	0.01	0.02
LDI	2	0.10	0.09	0.10	0.01	0.01
			ML 126-150 mm			
MWI	0	.	.	.	.	.
FLI	1	0.75	0.75	0.75	.	.
FWI	1	0.94	0.94	0.94	.	.
HLI	0	.	.	.	.	.
HWI	0	.	.	.	.	.
TILI	1	0.14	0.14	0.14	.	.
EDI	0	.	.	.	.	.
LDI	0	.	.	.	.	.

Table 4-7, continued

INDEX	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	STANDARD DEVIATION
ML 151-175 mm						
MWI	1	0.26	0.26	0.26	.	.
FLI	3	0.74	0.73	0.76	0.01	0.02
FWI	3	0.87	0.82	0.92	0.03	0.05
HLI	2	0.34	0.33	0.34	0.00	0.01
HWI	1	0.20	0.20	0.20	.	.
T1LI	3	0.14	0.12	0.16	0.01	0.02
EDI	1	0.18	0.18	0.18	.	.
LDI	1	0.05	0.05	0.05	.	.
ML 176-200 mm						
MWI	0	.	.	.	.	.
FLI	1	0.74	0.74	0.74	.	.
FWI	1	0.90	0.90	0.90	.	.
HLI	0	.	.	.	.	.
HWI	0	.	.	.	.	.
T1LI	1	0.14	0.14	0.14	.	.
EDI	0	.	.	.	.	.
LDI	0	.	.	.	.	.

Table 4-8: Means comparisons of mantle width between five species of *Octopoteuthis*.

ALPHA=.05 CONFIDENCE=0.95 DF=154 MSE=7709993
CRITICAL VALUE OF STUDENTIZED RANGE=3.904

COMPARISONS SIGNIFICANT AT THE .05 LEVEL ARE INDICATED BY '***'

SPECIES COMPARISON	SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT	
DANAE - SP A	-29.880	4.136	38.153	
DANAE - DELETRON	-16.531	11.136	38.804	
DANAE - MEGAPTERA	5.290	21.806	38.322	***
DANAE - SICULA	14.577	32.062	49.548	***
SP A - DANAE	-38.153	-4.136	29.880	
SP A - DELETRON	-32.580	7.000	46.580	
SP A - MEGAPTERA	-15.101	17.669	50.439	
SP A - SICULA	-5.343	27.926	61.195	
DELETRON - DANAE	-38.804	-11.136	16.531	
DELETRON - SP A	-46.580	-7.000	32.580	
DELETRON - MEGAPTERA	-15.450	10.669	36.789	
DELETRON - SICULA	-5.817	20.926	47.669	
MEGAPTERA - DANAE	-38.322	-21.806	-5.290	***
MEGAPTERA - SP A	-50.439	-17.669	15.101	
MEGAPTERA - DELETRON	-36.789	-10.669	15.450	
MEGAPTERA - MEGAPTERA	-4.659	10.257	25.172	
SICULA - DANAE	-49.548	-32.062	-14.577	***
SICULA - SP A	-61.195	-27.926	5.343	
SICULA - DELETRON	-47.669	-20.926	5.817	
SICULA - MEGAPTERA	-25.172	-10.257	4.659	

Table 4-9: Means comparisons of fin length between five species of *Octopoteuthis*.

ALPHA=.05 CONFIDENCE=0.95 DF=248 MSE=836.576
CRITICAL VALUE OF STUDENTIZED RANGE=3.886

COMPARISONS SIGNIFICANT AT THE .05 LEVEL ARE INDICATED BY '***'

SPECIES COMPARISON	SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT	
DANAE - SP A	-16.433	7.519	31.471	
DANAE - MEGAPTERA	18.467	31.857	45.248	***
DANAE - DELETRON	18.007	35.944	53.880	***
DANAE - SICULA	22.991	36.332	49.673	***
SP A - DANAE	-31.471	-7.519	16.433	
SP A - MEGAPTERA	0.307	24.338	48.370	***
SP A - DELETRON	1.593	28.425	55.256	***
SP A - SICULA	4.809	28.813	52.817	***
MEGAPTERA - DANAE	-45.248	-31.857	-18.467	***
MEGAPTERA - SP A	-48.370	-24.338	-0.307	***
MEGAPTERA - DELETRON	-13.956	4.086	22.129	
MEGAPTERA - SICULA	-9.009	4.475	17.958	
DELETRON - DANAE	-53.880	-35.944	-18.007	***
DELETRON - SP A	-55.256	-28.425	-1.593	***
DELETRON - MEGAPTERA	-22.129	-4.086	13.956	
DELETRON - SICULA	-17.618	0.388	18.395	
SICULA - DANAE	-49.673	-36.332	-22.991	***
SICULA - SP A	-52.817	-28.813	-4.809	***
SICULA - MEGAPTERA	-17.958	-4.475	9.009	
SICULA - DELETRON	-18.395	-0.388	17.618	

Table 4-10: Means comparisons of fin width between five species of *Octopoteuthis*.

ALPHA=.05 CONFIDENCE=0.95 DF=244 MSE=627.639
CRITICAL VALUE OF STUDENTIZED RANGE=3.887

COMPARISONS SIGNIFICANT AT THE .05 LEVEL ARE INDICATED BY '***'

SPECIES COMPARISON	SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT	
DANAE - SP A	-14.295	6.476	27.248	
DANAE - MEGAPTERA	20.976	32.749	44.521	***
DANAE - DELETRON	19.333	34.901	50.469	***
DANAE - SICULA	23.692	35.289	46.887	***
SP A - DANAE	-27.248	-6.476	14.295	
SP A - MEGAPTERA	5.380	26.272	47.165	***
SP A - DELETRON	5.181	28.425	51.668	***
SP A - SICULA	8.019	28.813	49.607	***
MEGAPTERA - DANAE	-44.521	-32.749	-20.976	***
MEGAPTERA - SP A	-47.165	-26.272	-5.380	***
MEGAPTERA - DELETRON	-13.577	2.152	17.882	
MEGAPTERA - SICULA	-9.272	2.541	14.354	
DELETRON - DANAE	-50.469	-34.901	-19.333	***
DELETRON - SP A	-51.668	-28.425	-5.181	***
DELETRON - MEGAPTERA	-17.882	-2.152	13.577	
DELETRON - SICULA	-15.210	0.388	15.987	
SICULA - DANAE	-46.887	-35.289	-23.692	***
SICULA - SP A	-49.607	-28.813	-8.019	***
SICULA - MEGAPTERA	-14.354	-2.541	9.272	
SICULA - DELETRON	-15.987	-0.388	15.210	

Table 4-11: Means comparisons of head length between five species of *Octopoteuthis*.

ALPHA=.05 CONFIDENCE=0.95 DF=158 MSE=660.67
CRITICAL VALUE OF STUDENTIZED RANGE=3.903

COMPARISONS SIGNIFICANT AT THE .05 LEVEL ARE INDICATED BY '***'

SPECIES COMPARISON	SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT	
SP A - DANAE	-18.261	11.039	40.339	
SP A - DELETRON	-16.455	18.500	53.455	
SP A - MEGAPTERA	0.937	29.267	57.596	***
SP A - SICULA	8.648	37.346	66.043	***
DANAE - SP A	-40.339	-11.039	18.261	
DANAE - DELETRON	-17.894	7.461	32.816	
DANAE - MEGAPTERA	3.274	18.228	33.181	***
DANAE - SICULA	10.668	26.307	41.946	***
DELETRON - SP A	-53.455	-18.500	16.455	
DELETRON - DANAE	-32.816	-7.461	17.894	
DELETRON - MEGAPTERA	-13.461	10.767	34.994	
DELETRON - SICULA	-5.810	18.846	43.502	
MEGAPTERA - SP A	-57.596	-29.267	-0.937	***
MEGAPTERA - DANAE	-33.181	-18.228	-3.274	***
MEGAPTERA - DELETRON	-34.994	-10.767	13.461	
MEGAPTERA - MEGAPTERA	-5.656	8.079	21.815	
SICULA - SP A	-66.043	-37.346	-8.648	***
SICULA - DANAE	-41.946	-26.307	-10.668	***
SICULA - DELETRON	-43.502	-18.846	5.810	
SICULA - MEGAPTERA	-21.815	-8.079	5.656	

Table 4-12: Means comparisons of head width between five species of *Octopoteuthis*.

ALPHA=.05 CONFIDENCE=0.95 DF=154 MSE=654.214
CRITICAL VALUE OF STUDENTIZED RANGE=3.904

COMPARISONS SIGNIFICANT AT THE .05 LEVEL ARE INDICATED BY '***'

SPECIES COMPARISON	SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT	
DANAE - SP A	-28.332	3.003	34.338	
DANAE - DELETRON	-15.483	10.003	35.489	
DANAE - MEGAPTERA	5.926	21.183	36.440	***
DANAE - SICULA	13.587	29.622	45.657	***
SP A - DANAE	-34.338	-3.003	28.332	
SP A - DELETRON	-29.460	7.000	43.460	
SP A - MEGAPTERA	-12.028	18.180	48.389	
SP A - SICULA	-3.989	26.619	57.228	
DELETRON - DANAE	-35.489	-10.003	15.483	
DELETRON - SP A	-43.460	-7.000	29.460	
DELETRON - MEGAPTERA	-12.907	11.180	35.268	
DELETRON - SICULA	-4.969	19.619	44.207	
MEGAPTERA - DANAE	-36.440	-21.183	-5.926	***
MEGAPTERA - SP A	-48.389	-18.180	12.028	
MEGAPTERA - DELETRON	-35.268	-11.180	12.907	
MEGAPTERA - SICULA	-5.265	8.439	22.142	
SICULA - DANAE	-45.657	-29.622	-13.587	***
SICULA - SP A	-57.228	-26.619	3.989	
SICULA - DELETRON	-44.207	-19.619	4.969	
SICULA - MEGAPTERA	-22.142	-8.439	5.265	

Table 4-13: Means comparisons of tail length between five species of *Octopoteuthis*.

ALPHA=.05 CONFIDENCE=0.95 DF=248 MSE=815.755
CRITICAL VALUE OF STUDENTIZED RANGE=3.886

COMPARISONS SIGNIFICANT AT THE .05 LEVEL ARE INDICATED BY '***'

SPECIES COMPARISON	SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT	
DANAE - SP A	-16.133	7.519	31.171	
DANAE - MEGAPTERA	18.635	31.857	45.080	***
DANAE - DELETRON	18.232	35.944	53.655	***
DANAE - SICULA	23.158	36.332	49.506	***
SP A - DANAE	-31.171	-7.519	16.133	
SP A - MEGAPTERA	0.608	24.338	48.069	***
SP A - DELETRON	1.929	28.425	54.920	***
SP A - SICULA	5.109	28.813	52.516	***
MEGAPTERA - DANAE	-45.080	-31.857	-18.635	***
MEGAPTERA - SP A	-48.069	-24.338	-0.608	***
MEGAPTERA - DELETRON	-13.730	4.086	21.903	
MEGAPTERA - SICULA	-8.840	4.475	17.789	
DELETRON - DANAE	-53.655	-35.944	-18.232	***
DELETRON - SP A	-54.920	-28.425	-1.929	***
DELETRON - MEGAPTERA	-21.903	-4.086	13.730	
DELETRON - SICULA	-17.392	0.388	18.169	
SICULA - DANAE	-49.506	-36.332	-23.158	***
SICULA - SP A	-52.516	-28.813	-5.109	***
SICULA - MEGAPTERA	-17.789	-4.475	8.840	
SICULA - DELETRON	-18.169	-0.388	17.392	

Table 4-14: Means comparisons of eye diameter between five species of *Octopoteuthis*.

ALPHA=.05 CONFIDENCE=0.95 DF=157 MSE=685.482
CRITICAL VALUE OF STUDENTIZED RANGE=3.903

COMPARISONS SIGNIFICANT AT THE .05 LEVEL ARE INDICATED BY '***'

SPECIES COMPARISON	SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT	
DANAE - SP A	-30.524	1.403	33.329	
DANAE - DELETRON	-21.102	5.903	32.908	
DANAE - MEGAPTERA	3.538	18.814	34.091	***
DANAE - SICULA	11.188	27.249	43.309	***
SP A - DANAE	-33.329	-1.403	30.524	
SP A - DELETRON	-33.582	4.500	42.582	
SP A - MEGAPTERA	-13.481	17.411	48.304	
SP A - SICULA	-5.442	25.846	57.133	
DELETRON - DANAE	-32.908	-5.903	21.102	
DELETRON - SP A	-42.582	-4.500	33.582	
DELETRON - MEGAPTERA	-12.863	12.911	38.685	
DELETRON - SICULA	-4.900	21.346	47.592	
MEGAPTERA - DANAE	-34.091	-18.814	-3.538	***
MEGAPTERA - SP A	-48.304	-17.411	13.481	
MEGAPTERA - DELETRON	-38.685	-12.911	12.863	
MEGAPTERA - SICULA	-5.457	8.435	22.326	
SICULA - DANAE	-43.309	-27.249	-11.188	***
SICULA - SP A	-57.133	-25.846	5.442	
SICULA - DELETRON	-47.592	-21.346	4.900	
SICULA - MEGAPTERA	-22.326	-8.435	5.457	

Table 4-15: Means comparisons of lens diameter between five species of *Octopoteuthis*.

ALPHA=.05 CONFIDENCE=0.95 DF=148 MSE=689.211
CRITICAL VALUE OF STUDENTIZED RANGE=3.906

COMPARISONS SIGNIFICANT AT THE .05 LEVEL ARE INDICATED BY '***'

SPECIES COMPARISON		SIMULTANEOUS LOWER CONFIDENCE LIMIT	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS UPPER CONFIDENCE LIMIT	
SP A	- DELETRON	-33.712	4.500	42.712	
SP A	- DANAE	-25.824	6.600	39.024	
SP A	- MEGAPTERA	-14.752	16.292	47.335	
SP A	- SICULA	-5.436	26.035	57.505	
DELETRON	- SP A	-42.712	-4.500	33.712	
DELETRON	- DANAE	-25.455	2.100	29.655	
DELETRON	- MEGAPTERA	-14.125	11.792	37.709	
DELETRON	- SICULA	-4.891	21.535	47.961	
DANAE	- SP A	-39.024	-6.600	25.824	
DANAE	- DELETRON	-29.655	-2.100	25.455	
DANAE	- MEGAPTERA	-6.520	9.692	25.904	
DANAE	- SICULA	2.420	19.435	36.449	***
MEGAPTERA	- SP A	-47.335	-16.292	14.752	
MEGAPTERA	- DELETRON	-37.709	-11.792	14.125	
MEGAPTERA	- DANAE	-25.904	-9.692	6.520	
MEGAPTERA	- SICULA	-4.466	9.743	23.952	
SICULA	- SP A	-57.505	-26.035	5.436	
SICULA	- DELETRON	-47.961	-21.535	4.891	
SICULA	- DANAE	-36.449	-19.435	-2.420	***
SICULA	- MEGAPTERA	-23.952	-9.743	4.466	

The first DISCRIM procedure produced a table giving the number of observations and the percents classified into species (see Table 4-16(a.)). Based on the analysis 73.7 per cent of the initial species assignments appeared correct. After removal one of the species with a very low sample number (*O.* sp A) the analysis recognized 78.1 per cent of the initial assignments correct (see Table 4-16 (b.)).

Table 4-16: Discriminant analysis of species designation of (a.) five species of the genus *Octopoteuthis* and (b.) four species of the genus after removal of *O.* sp A.

NUMBER OF OBSERVATIONS AND PERCENTS CLASSIFIED INTO SPECIES:

FROM SPECIES		DANAE	DELETRON	MEGAPTERA	SICULA	SP A	TOTAL
UNKNOWN		4	1	5	14	6	30
		13.33	3.33	16.67	46.67	20.00	100.00
DANAE		19	0	0	2	2	23
		82.61	0.00	0.00	8.70	8.70	100.00
DELETRON		1	7	0	1	0	9
		11.11	77.78	0.00	11.11	0.00	100.00
MEGAPTERA		5	3	30	8	10	56
		8.93	5.36	53.57	14.29	17.86	100.00
SICULA		10	0	1	32	2	45
		22.22	0.00	2.22	71.11	4.44	100.00
SP A		0	0	1	0	5	6
		0.00	0.00	16.67	0.00	83.33	100.00
TOTAL		39	11	37	57	25	169
PERCENT		23.08	6.51	21.89	33.73	14.79	100.00
PRIORS		0.2000	0.2000	0.2000	0.2000	0.2000	

NUMBER OF OBSERVATIONS AND PERCENTS CLASSIFIED INTO SPECIES:

FROM SPECIES	DANAE	DELETRON	MEGAPTERA	SICULA	TOTAL
UNKNOWN	4	1	15	16	36
	11.11	2.78	41.67	44.44	100.00
DANAE	20	0	0	3	23
	86.96	0.00	0.00	13.04	100.00
DELETRON	1	7	0	1	9
	11.11	77.78	0.00	11.11	100.00
MEGAPTERA	5	3	40	8	56
	8.93	5.36	71.43	14.29	100.00
SICULA	10	0	2	33	45
	22.22	0.00	4.44	73.33	100.00
TOTAL	40	11	57	61	169
PERCENT	23.67	6.51	33.73	36.09	100.00
PRIORS	0.2500	0.2500	0.2500	0.2500	

4.13. Arm Regeneration in Octopoteuthis

Individuals of *Octopoteuthis* have very brittle arms, the tips of which are almost always lost when specimens are collected by standard gear types. This is particularly true of juveniles and adults. Arms commonly remain intact however when whole specimens are collected from the stomachs of large predators, due to the manner of their being ingested whole.

Arm length ratios are commonly used as systematic characteristics (Roper and Voss, 1983). It was during the examination of complete arms on the specimens that arm regeneration was discovered. In all, 15 of the specimens examined showed evidence of one or more arms regenerating; including the holotype of *Octopoteuthis deletron* (see Fig. 4-19).

Arm and tentacle regeneration has been found in a number of different cephalopods (Adam, 1937; Aldrich and Aldrich, 1968; Lange, 1920; and Murata *et al.*, 1981). A search of the pertinent literature revealed only one reference to this phenomenon in the genus *Octopoteuthis*. Rancurel, in his 1970 paper included but a single line with regards to regeneration, namely:

> "*Sur l'echantillon no.21, les trois bras droits superiors ont ete rompus, anterieurement a la capture, et ont commence a regenerer sur une longeur de 2 a 3 mm.*"

Regeneration is easily identifiable by several means (see Figs 4-19 and 4-20). First, the regenerated portions generally appear narrower than the basal (undamaged) portion of the arms (Fig 4-19 b). Second, the normally encountered alternating pattern in the arm hooks is interrupted and there will be two or even three hooks produced in one row before another hook appears in the opposite row.

The arm and its accessory structure appear to have the ability to regenerate, including the hooks, the distal suckers, the spindle-shaped distal photophores and the photophores along the axial nerve. Injury or loss at any point along the arm can lead to regeneration of the missing portion or structures.

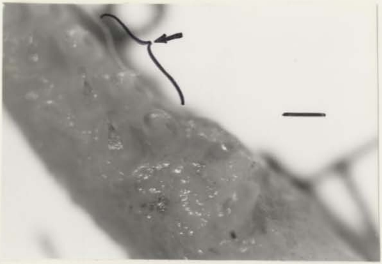


Figure 4-19: Photograph showing regeneration of arm RIII in the holotype of *Octopoteuthis deletron* Young, 1972. (Scale = 1 mm)

Figure 4-20: Photographs showing regeneration of arms in specimens of *Octopoteuthis* (a.) arm pair with one arm regenerating, (b.) diameter difference between basal and regenerating portion (Scale = 1 mm).

a.

b.

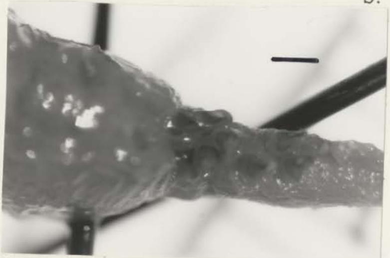


Figure 4-21: Photographs showing arm regeneration in *Octopoteuthis* (a.) regenerating arm showing reformed spindle-shaped photophore at tip, (b.) change in armature patterning on regenerating arm. (Scale in mm)

Chapter 5
Discussion

5.1. Species Validity

In the past several authors have attempted to clarify the status of the 9 nominal species. Young (1972) discussed the then 8 nominal species and considered the most important characters to be the presence of 1 or 2 ventral abdominal photophores, tail length, and presence or absence of accessory cusps on the arm hooks. He considered *Octopoteuthis persica* and *O. indica* to be *nomina dubia* because their small size precluded accurate identification. He also believed that *O. persica* was really the young of *Taningia danae* based on the distinct swellings at the tips of arms II. Young questioned the validity of *O. longiptera* because the limited number of characters, used by Akimushkin, did not clearly separate it from other species. Although Young was unable to identify characters essential for a definition of *O. nielseni* he considered that it was a valid species. He thus considered the following species valid: *O. danae*, *O. megaptera*, and his *O.* sp A in the Atlantic, and *O. deletron* and *O. nielseni* in the Pacific. He suggested that one of the three Atlantic species, probably *O. danae*, was a synonym of *O. sicula*.

Clarke (1980) agreed with Young's opinions on *O. persica* and *O. indica* but he considered *O. longiptera* to be a valid species based on it's size being considerably larger than that of any previous specimens captured. He also questioned Young's assumption that all *Octopoteuthis* species bear photophores. Clarke expressed some doubt on the distinction between *O. sicula*, *O. megaptera* and his new species *O. rugosa*, basing his opinion, at least in part, on incomplete data with respect to photophores in the two species. On the matter of photophores Clarke is, at best, inconsistent.

Nesis (1983) produced a key to the genus *Octopoteuthis* and listed only seven species: *O. danae*, *O. deletron*, *O. sicula*, *O. megaptera*, *O. rugosa*, *O. nielseni*, and *O.* sp A. He made note that *O. longiptera* was lacking in good diagnostic characters.

The present study supports the validity of only four of the nine nominal species plus Young's as yet unnamed sp A (see Table 5-1). In addition, one other species is described here. Examination of specimens available have supported Young's assumption that all individuals greater than 20-25 mm ML bear photophores other than those at the arm tips. All species discussed below are determined by a combination of three photophore groups (ventral abdominal, anterior eyelid, and eyeball) and the presence or absence of accessory cusps on the arm hooks.

It should be noted that although all attempts were made to obtain representative specimens from all oceans several major areas were little, if at all represented. These include the Northwestern Pacific, Southeastern Pacific and Indian Oceans. The large Russian and Japanese collections of this genus (literature reports and personal communication - Yu. Froeman, K. N. Nesis and T. Okutani) may possibly contain additional species and their re-examination based on this study's results will certainly improve our knowledge.

Young and Roper (1977) observed live specimens of what they identified as *Octopoteuthis nielseni* and reported five small additional mantle photophores: one, located laterally, on either side of the mantle at the same level as the pair lying on the ventrum of the ink sac; a single photophore lying centrally and just anterior to the ventral abdominal pair; and one to each side of the single centre one and lying laterally. None of these five photophores could be found on any of the specimens examined in this study. Young also has been unable to find these

Table 5-1: Checklist of all names proposed for *Octopoteuthis* and their validity after this revision.

Taxon	Validity after this Revision
FAMILIES:	
Veranyidae Chun, 1910	Invalid
Octopodoteuthidae Berry, July, 1912	Invalid
Octopoteuthidae Berry, November, 1912	Valid
GENERA:	
Octopoteuthis Rüppell, 1844	Valid
Octopodoteuthis Krohn, 1845	Invalid
Verania Krohn, 1847	Invalid
Veranya Keferstein, 1866	Invalid
Octopodoteuthopsis Pfeffer, 1912	Invalid
SPECIES (listed with the valid generic name):	
Octopoteuthis sicula Rüppell, 1844	Valid
O. megaptera Verrill, 1885	Valid
O. persica Naef, 1923	Invalid
O. indica Naef, 1923	Invalid
O. danae Joubin, 1931	Valid
O. neilseni Robson, 1948	Invalid
O. longiptera Akimushkin, 1963	Invalid
O. deletron Young, 1972	Valid
O. rugosa Clarke, 1980	Invalid
O. sp A	Valid

photophores in any preserved specimens he has examined (personal communication). With the extremely dehydrated condition of the Robson's syntypes identification of characters is impossible.

All specimens collected in the eastern Pacific and originally thought to be *Octopoteuthis nielseni* have been found to bear eyeball and anterior eyelid photophores, paired abdominal photophores and cusps on their hooks. Based on those characters used in this study it would seem that the specimens examined, from the Pacific, are the same as those specimens described as species C, from the Atlantic, above and classified as *Octopoteuthis megaptera*. As more squid families are examined it becomes apparent that species squid have distribution patterns reflecting the geographic patterns of Backus and Craddock,1977 and others. It may turn out that *Octopoteuthis nielseni* may represent a valid Pacific form similar to the Atlantic *megaptera* but this remains questionable at the present time. *O. nielseni* must at present be considered a *nomen dubium*.

Originally it had been planned to obtain Mediterranean specimens in an attempt to clarify the identity of the type species *O. sicula*. Although over one hundred institutes and museums were contacted worldwide only a handful of Mediterranean specimens were obtained. These were all very young animals and only one specimen, from the type locality, had a discernable photophore pattern.

Naef's *Octopoteuthis indica* was a larval specimen and no taxonomically useful characters could be attributed to it. His second species *Octopoteuthis persica* is actually a larval *Taningia danae* as both Young and Clarke had supposed. The two species named by Naef in 1923, and first described by Chun in 1910 as *Octopodoteuthis* sp, must then be considered *nomina dubia*.

The holotypes of Verrill's *Octopoteuthis megaptera* and Akimushkin's *O. longiptera* have been lost and no photophore pattern has ever been described for either. To maintain *longiptera* as valid on the basis of a few body measurements seems to be unjustifiable. There is absolutely no way to ascertain if it could be applied to any valid species so it seems wise to name *longiptera* a *nomen dubium*.

As revealed in the results of this study both the holotype and paratype of *Octopoteuthis rugosa* were found to be characterized by widely distributed photophores. Specifically they are to be found on the posterior ventrum of the mantle, the posterior ventrum of the eyelid, along the axial nerves of at least the ventral arms and lying ventral to the ink sac and dorsal to the musculi recti abdominalis. Unfortunately, because of partial digestion, it could not be determined if the specimens bore either the anterior eyelid or eyeball photophores. The complete photophore pattern was therefore unobtainable so *O. rugosa* can neither be placed within an existing species nor stand alone as a valid species. It must then be considered a *nomina dubium*.

The International Code of Zoological Nomenclature (International Commission for Zoological Nomenclature 1985) rules that changes in species validity, like those proposed above, are only legal if presented in a recognized publication (Article 11(a)). As a thesis is not a recognized publication (Article 9(11)) a manuscript is now in preparation for publication which includes the above changes as well as a name for species A, all in accordance with the code.

5.2. An Artificial Key to the Species of Octopoteuthis

1 a. **A single photophore located ventrally and superficially on the posterior portion of the mantle at the muscle-gelatinous layers interface** **2**

1 b. **A pair of photophores located ventrally on the posterior portion of the mantle at the muscle-gelatinous layers interface** **3**

2 a. **Accessory cusps present on arm hooks even in young stages (20-25 mm ML); species found in the eastern Pacific** .... ***O. deletron***

2 b. **Accessory cusps absent on arm hooks even in young stages (20-25 mm ML); species found primarily in the North Atlantic** .... ***O. sp A***

3 a. Single crescent-shaped photophore present on each eyeball; anterior eyelid photophore present .... *O. megaptera*

3 b. Single crescent-shaped photophore absent on each eyeball; anterior eyelid photophore absent 4

4 a. Accessory cusps present on arm hooks even in young stages (20-25 mm ML) .... *O. sicula*

4 b. Accessory cusps absent on arm hooks even in young stages (20-25 mm ML) .... *O. danae*

Table 5-2 below lists the characters and character states of the five valid species.

Table 5-2: Characters and character state distribution of the five valid species of *Octopoteuthis*

Species	Abdominal Photophores	Eye Photophores	Accessory Hook Cusps	Eyelid Photophores
O. danae	2	absent	absent	absent
O. deletron	1	absent	present	present
O. sp A	1	absent	absent	present
O. sicula	2	absent	present	absent
O. megaptera	2	present	present	present

5.3. Distribution

The distribution of the genus *Octopoteuthis* appears to be extremely widespread ranging from sub-Arctic to Antarctic waters. Most collections are from offshore locations but captures are recorded near continents where the continental shelf is very close to shore.

Of the 285 juvenile and maturing specimens (identified and unidentified) which had depth data, 194 (64.8 per cent) were collected in the first 500 metres of water and a total of 250 (80.6 per cent) in the first 1000 metres.

The following sections describe the geographic and vertical distribution of each of the five species described above. The zoogeographic terms used for pelagic faunal regions in the Atlantic are those defined by Backus and Craddock (1977) and Backus *et al.* (1977).

Because of the problem of identifying *Octopoteuthis* larvae to species they are discussed as a group on their own. Unfortunately because of the large number of sources of specimens some data were unobtainable, particularly time of collection. This hindered somewhat the examination of vertical migration.

5.3.1. *Octopoteuthis sicula*

Geographic Distribution.-Found primarily in the western North Atlantic in the slope water province of the North Atlantic temperate region (see Fig 5-1). Also located in Gulf of Mexico and northen Sargasso Sea of the North Atlantic subtropical region and the Caribbean Sea and Amazonian provinces of the Atlantic tropical region. Two specimens were collected, one from off of west Africa in the Northern Mauritanian upwelling province and the second from the Indian Ocean.

Vertical Distribution.-Of the 78 specimens of the species only 62 individuals had depth capture data available. All specimens were collected in the top 1000 metres of water at depths ranging between 24 and 1000m (see Fig 5-2). Nearly 81 percent of them were collected in the first 500 metres. Twenty-three animals were collected in the first 100 metres of water (17 from 2 tows). All known night captures (16) were found in the first 500 metres. Of the seven known daytime captures the deepest was collected from gear fishing at 800 metres.

Figure 5-1: Map showing distribution of the *Octopoteuthis sicula* Rüppell, 1844

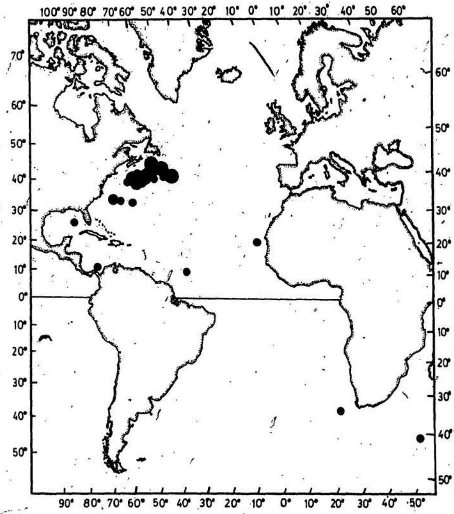
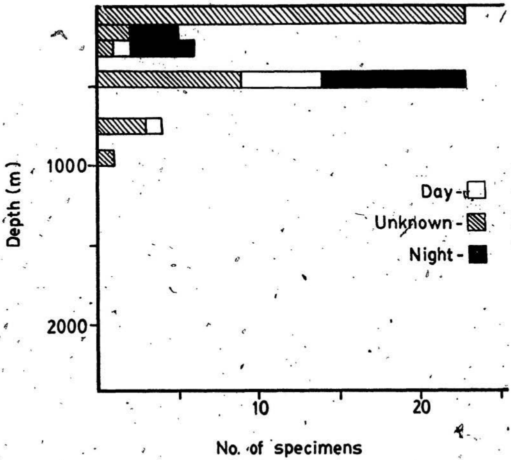

100° 90° 80° 70° 60° 50° 40° 30° 20° 10° 0° 10° 20° 30° 40° 50 60°
70° 60° 50° 40° 30° 20° 10° 0° 10° 20° 30° 40° 50°
60° 50° 40° 30° 20° 10° 0° 10° 20° 30° 40° 50°
90° 80° 70° 60° 50° 40° 30° 20° 10° 0° 10° 20° 30° 40° 50°

Figure 5-2: Vertical distribution of *Octopoteuthis sicula* Rüppell, 1844.


Depth (m)
1000
2000
10
20
No. of specimens
Day -
Unknown -
Night -

5.3.2. *Octopoteuthis megaptera*

Geographical Distribution.-A very widespread species found throughout the Atlantic between 45° N and 50° S including: the slope water and Mediterranean outflow provinces of the North Atlantic temperate region; the Straits of Florida, Amazonian and Guinean provinces of the the Atlantic tropical region; the South Atlantic subtropical sea and off the coast of South Africa. Also found throughout the Indian Ocean and off Eastern Australia in the western Pacific. (See Fig 5-3)

Vertical Distribution.-Fifty-seven specimens of *megaptera* were collected from gear fished from 25-4046 metres. MOCNESS captures were from 100 and 250 metres (see Fig 5-4). Eighty-eight percent of all captures were from the first 1000 metres (70 percent in the first 500 metres). All nighttime captures were in the first 1000 metres. The only known twilight capture was from a gear fished at 1000 metres.

Figure 5-3: Map showing distribution of *Octopoteuthis megaptera* (Verrill, 1885)

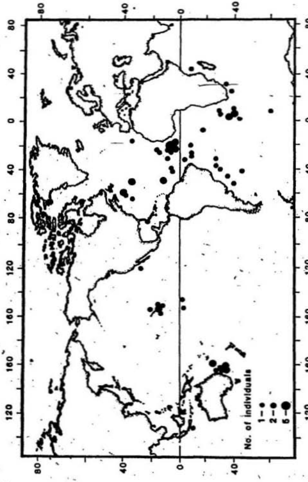

No. of individuals
1 –
2 –
5 –

Figure 5-4: Vertical distribution of *Octopoteuthis megaptera* (Verrill, 1885)

5.3.3. *Octopoteuthis danae*

Geographic Distribution.-Octopoteuthis danae appears to be a Northwest Atlantic species collected between 35° and 45° N (see Fig 5-5). It is primarily found in the slope water of the North Atlantic temperate region. Several specimens have also been collected in the North Sargasso Sea province of the North Atlantic subtropical region. Single specimens have been collected from off west Africa in the southern Mauritanian upwelling and from off South Africa. Two additional specimens were collected from off Eastern Australia. Tthe identification of the Australian specimens is doubtful.

Vertical Distribution.-Of the 33 individuals identified as *danae* only 21 had depth data available. Captures ranged from 100-4850 metres with 15 (60 per cent) of the captures coming from the first 500 metres (see Fig 5-6). There were 12 known nighttime captures, all above 1000 metres, with 11 of them in the top 500 metres. The two recorded daytime captures were from 200 and 500 metres respectively. The deepest capture using a MOCNESS closing net was at night while fishing at 441 metres depth.

Figure 5-5: Map showing distribution of *Octopoteuthis danae* Joubin, 1931.

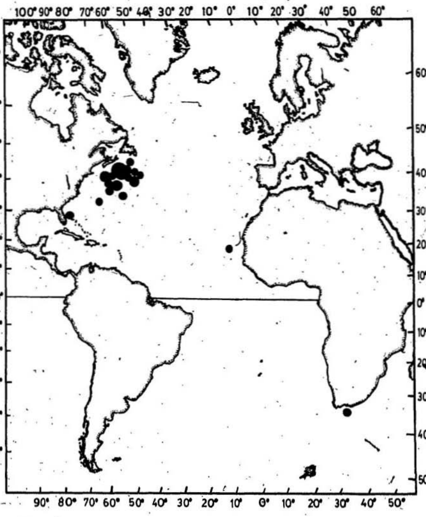
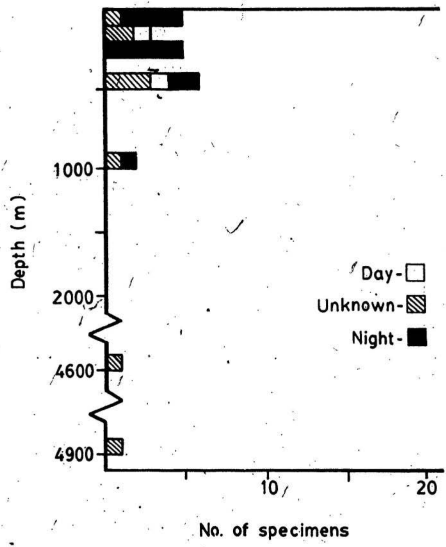

100° 90° 80° 70° 60° 50° 40° 30° 20° 10° 0° 10° 20° 30° 40° 50 60°
70°
60°
50°
40°
30°
20°
10°
0°
10°
20°
30°
40°
50°
60°
50°
40°
30°
20°
10°
0°
10°
20°
30°
40°
50°
90° 80° 70° 60° 50° 40° 30° 20° 10° 0° 10° 20° 30° 40° 50°

Figure 5-6: Vertical distribution of *Octopoteuthis danae* Joubin, 1931.



Depth (m)
1000
2000
4600
4900
10
20
No. of specimens
Day -
Unknown -
Night -

5.3.4. *Octopoteuthis deletron*

Geographic Distribution.-*Octopoteuthis deletron* is found in the eastern Pacific primarily off California, Washington and Oregon 30° to 40° N and 118° to 128° W (see Fig 5-7).

Vertical Distribution.-A total of 29 specimens (18 with depth data) of *deletron* were collected from gear fished at depths of 274-5500 metres (see Fig 5-8). Seven were caught above 1000 metres and 14 were caught above 2000 metres. Of the remaining six specimens, three were collected from gear fished down to 2300 metres and the remaining three were collected from gear fished at 3000, 4500, and 5500 metres respectively. Six of the seven known night captures were from 2000 metres or above.

Figure 5-7: Map showing distribution of *Octopoteuthis deletron* Young, 1972.

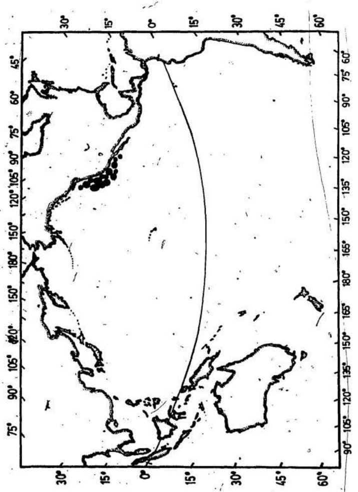
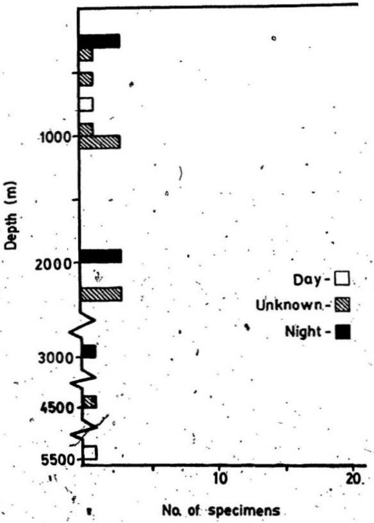

30° 15° 0° 15° 30° 45° 60°
45° 60° 75° 90° 105° 120° 150° 180° 150° 120° 105° 90° 75°
60° 75° 90° 105° 120° 135° 150° 165° 180° 165° 150° 135° 120° 105° 90°
30° 15° 0° 15° 30° 45° 60°

Figure 5-8: Vertical distribution of *Octopoteuthis deletron* Young, 1972.


Depth (m)
1000
2000
3000
4500
5500
10
20.
No. of specimens
Day -
Unknown -
Night -

5.3.5. *Octopoteuthis* sp A

Geographical Distribution.-*O.* sp A is primarily distributed in the North Atlantic between 20° and 40° N in the north and south Sargasso Sea provinces of the Atlantic subtropical region (see Fig 5-9). Other specimens were collected from the northern and southern Mauritanian upwelling provinces of the North African subtropical sea. A single specimen was collected from off South America in the South Atlantic subtropical sea.

Vertical Distribution.-Only nine specimens of sp A had depth data available (see Fig 5-10). Six of the specimens were collected from 500 metres or less and all nine were collected from 800 metres or less. There were four known nighttime captures; one from 300, one from 500 and two from the 800 metre depth.

Figure 5-9: Map showing distribution of Young's *Octopoteuthis* sp A.

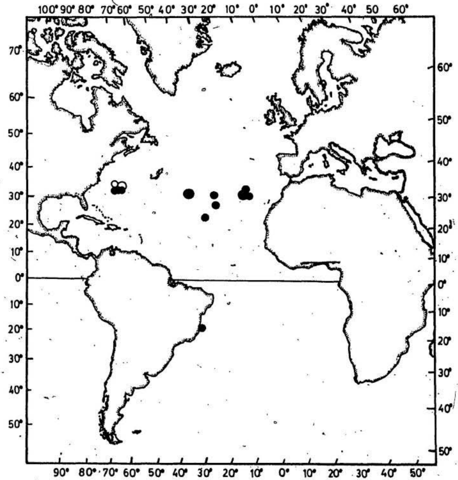
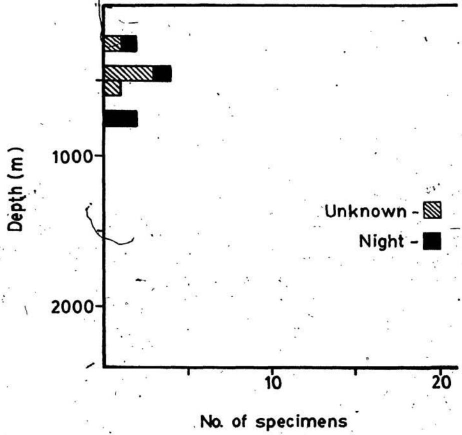

100° 90° 80° 70° 60° 50° 40° 30° 20° 10° 0° 10° 20° 30° 40° 50 60°
70°
60°
50°
40°
30°
20°
10°
0°
10°
20°
30°
40°
50°
60°
50°
40°
30°
20°
10°
0°
10°
20°
30°
40°
50°
90° 80° 70° 60° 50° 40° 30° 20° 10° 0° 10° 20° 30° 40° 50°

Figure 5-10: Vertical distribution of Young's *Octopoteuthis* sp A.


Depth (m)
1000
2000
Unknown
Night
10
20
No. of specimens

5.4. Larval Distribution

Geographical Distribution.-In all, a total of 146 larval specimens were examined representing collections from the Atlantic, Indian, and Pacific Oceans and the Mediterranean Sea. The adult characters normally used to separate species (photophore patterns and number and the presence or absence of accessory cusps on arm hooks) do not develop early enough to be useful for species identification in larvae. At present no other characters have been identified that can accurately separate larval *Octopoteuthis* into species. All specimens discussed will, therefore, be referred to as *Octopoteuthis* spp.

The largest number of specimens examined, totalling 106, came from the Atlantic. Of those 105 were from the North Atlantic and a single specimen came from off the western coast of South Africa (see Fig 5-11). Atlantic specimens were collected in all months except December and January with highest catches in March, April and June (see Fig 5-12).

Only 40 other specimens were examined, 6 and 29 from the Pacific and Indian Oceans respectively, and 5 from the Mediterranean Sea. To suppliment the sparse data the literature was searched for information on additional larvae (Mediterranean - Degner 1925, Issel 1925; Pacific - Okutani and McGowan 1969; and the Atlantic - Cairns, 1976, Massy 1909).

An attempt was made to compare these monthly distributions with those of mature and maturing adult specimens (ie. those showing evidence of gametes) of various species to aid in larval identification. All species of *Octopoteuthis*, however, seem to have a prolonged period of maturity that can span six to eight months of the year.

Vertical Distribution.-Captures of specimens occurred using a variety of gear types fishing at depths of 23-3500 m (see Fig. 5-13). Only 13 specimens lacked gear depth information (8 of those were from a single MOCNESS station).

Figure 5-11: Map of distribution of *Octopoteuthis* spp larvae.

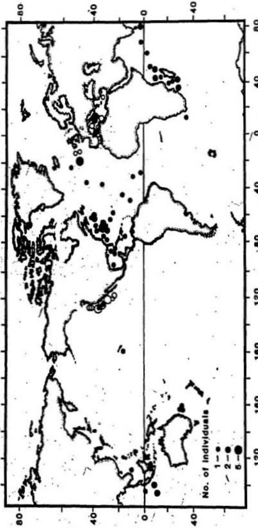
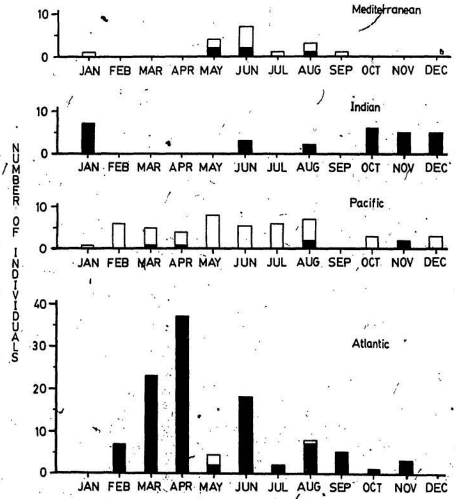

No. of Individuals
1 —
2 —
5 —

Figure 5-12: Monthly distribution of *Octopoteuthis* spp larvae based on catch data.


Mediterranean
Indian
Pacific
Atlantic
NUMBER OF INDIVIDUALS
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
0
10
20
30
40

Of the 133 specimens with depth data 71 percent were collected in the first 500 m of depth and 90 percent in the first 1000 m (all gears combined).

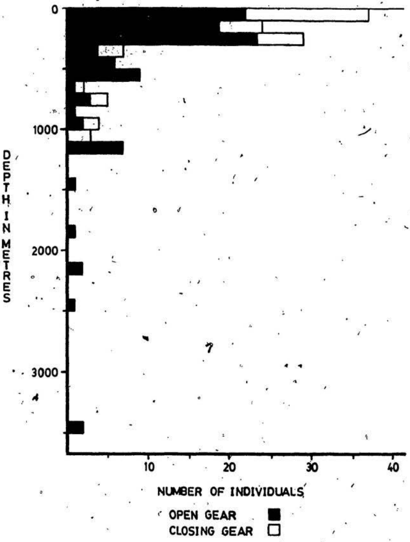
Daytime captures of larvae ranged from 55-1200 m for closing nets (55-1500 m for all gears). Of the 31 known daytime captures 16 were collected in the first 500 m and 15 in the next 1000 m. Night-time captures ranged from 50-1000 m for closing nets (50-3500 m for all gears). Fifty-four larvae were nighttime captures with 40 of those collected in the top 500 m. The heaviest nighttime concentration (31 individuals) was distributed between 100-400 m.

Although not closely looked at, size of individual animals (ML) did not seem to restrict vertical distribution. One daytime catch using a MOCNESS at 1050 m yielded a pair of larvae with MLs of 5.8 and 15.5 respectively. Two separate nighttime trawls in comparison, one at 23 and another at 50 m, yielded specimens of 16.8 and 1.9 mm ML.

Some of the present observations seem to agree with those of Róper and Young (1975). They reported day and night trawl catches of 60 and 81 percent respectively, of larvae of *Octopoteuthis deletron* Young, 1972 in the first 500 m of water. The remainder of their specimens were collected in the next 700 m. In comparison, only 4 specimens out of 146 reported on in this paper came from gear fished at depths greater than 1200 m. These deepwater records are probably the result of catches while the nets were being set.

Roper and Young also found that nighttime vertical distribution (near surface to 500 m) of *Octopóteuthis deletron* larvae encompassed and spread beyond their daytime distribution (200-400 m). *O. deletron* larvae were also absent from the upper 200 m of water. Unlike Roper and Young's observations however, a substantial number of larvae (one third of all day-time catches) were found to inhabit the top 200 metres. There also did not appear to be any substantial difference between day and nighttime range distribution (55-1200 and 50-1000 m respectively) when looking at results from closing gear.

Figure 5-13: Vertical distribution of *Octopoteuthis* spp larvae.


0
1000
2000
3000
DEPTH IN METRES
10
20
30
40
NUMBER OF INDIVIDUALS
OPEN GEAR
CLOSING GEAR

7

5.5. Gladius

Toll (1982) looked at the structure of the gladius in most of the teuthoid squids and found it to be quite distinctive between families, some genera and somtimes even species specific. Due to a shortage of available specimens he was unable to determine the full structure of the gladius of the genus *Octopoteuthis* but he did report Clarke's 1980 comment that at least *O. rugosa* had a conus. The present study has verified the presence of what Toll (1982) calls a secondary conus in all species of *Octopoteuthis*. This secondary conus is formed by the ventral fusion of the vanes of the gladius. The species of *Octopoteuthis* appear to have very different gladii but because of the small number examined (1-3) from each species inter- and intraspecific variability cannot be measured at this time. Examination should certainly be focussed in this area in any future studies in this genus.

5.6. Arm Loss and Regeneration

The loss of arms (at least the distal portion of them) is extremely common in the genus *Octopoteuthis*. So common in fact, that it is quite unusual to collect a specimen having more than one or two complete arms. Very few other groups of teuthoid squids, even the smallest species, undergo such loss during capture. Evidence that arm loss occurs during capture is supported by the frequent collection of detached arm tips with and without accompanying specimens (personal observation). The other valid genus in the family Octopoteuthidae, *Taningia*, rarely has incomplete arms, unlike the case in *Octopoteuthis*.

The causes of such arm loss may be several but one of the most probable reasons is due to the presence of photophores on all the arm tips and the behavioural and ecological consequences thereof. In an environment where available light levels are very low, such as is the case of the midwater depths usually inhabited by *Octopoteuthis*, any sources of light, no matter how faint, may serve as lures for prey or signals for species recognition. It may also inadvertently attract predators to the animal and result in capture of the individual squid if some alternative action could not take place. The autotomy of one or several arms would leave a predator busy and allow the squid a chance to escape relatively unharmed (much like some lizards that loose their tails when attacked). Of course, loss of parts of arms to predation may not be excluded.

Such action would be detrimental to the individual animal if no means were available to replace the lost parts. Arm regeneration would appear to be the natural physiological response to such a situation.

Lange (1920) was the first to study regeneration of cephalopods (primarily octopods) in detail. She noted that there was wound healing in teuthoids but that the occasional case of regeneration is by what she labels "compensatory regulation". She stated that lost arms were replaced and not repaired "by developing that rudimentary buccal arm which was correlated to the lost arms". The "replaced arm" differs from the original in length and in that it occupies a position nearer the buccal membrane.

Aldrich and Aldrich (1968) disagreed with Lange in respect to the process of arm and tentacle regeneration of at least some of the teuthoids. Their examination of a specimen of *Architeuthis dux* Steenstrup, and review of the literature on regeneration in other species (*Loligo pealei* and *Illex illecebrosus* (Verrill, 1881); *Architeuthis harvyi* (Verrill, 1882); and *Sepioteuthis lessoniana* (Adam, 1937)) revealed that regeneration was certainly more complicated than Lange supposed.

Murata *et al.* (1981) looked at tentacle and arm regeneration in *Ommastrephes bartrami* (Lesueur). They found regenerated portions to be generally shorter and suckers on those portions to be smaller, fewer in number, and irregular in configuration. Percentages of captured squids with evidence of regeneration ranged fom 0-17.1 per cent over a three year sampling period.

The last two papers above corroborate the present findings of the degree of complexity that can occur in teuthoid arm (and tentacle) regeneration. The percentage of regeneration in *Ommastrephes bartrami* is approximately equal to the nearly 15 per cent found in the *Octopoteuthis* specimens examined here. It would certainly seem that regeneration is much more common in teuthoids than had previously been thought.

5.7. Photophores and Bioluminescence

It is surprising in a squid genus like *Octopoteuthis*, which bears many photophores, that the discovery of their bioluminescent function took so long. Nearly fifty years after *O. sicula* was first described Chun (1910) was one of the first researchers to suggest that the outgrowths located near the ink sac were photophores. In 1912 Pfeffer proposed two other possible photophore sites; at the distal extremities of the arm tips and on the ventral sides of the eye (lid ?). Berry (1920a and b) tentatively listed the genus as being bioluminescent. In 1923 Naef accepted the presence of the arm tip photophores but doubted the nature of those organs lying ventrally against the ink sac.

Okada (1927) carried out the first histological study of the three supposed photophore groups. His conclusion was that the only photophores in *Octopoteuthis* were those located at the arm tips. In 1929 Pierantoni carried out a similar examination and appeared to be totally unaware of the work done two years earlier by Okada. Pierantoni found *Octopoteuthis* to be a luminescent species. In the same year, in Japan, Sasaki described arm tip photophores from specimens of *Octopoteuthis* specimens from Japan.

In 1931, Joubin described his new species *Octopodoteuthis danae* as having four pairs of photophores but was unable to conduct histological studies on them because of the poor condition of the specimen and its tissues.

Harvey (1952) in his classic text on bioluminescence listed *Octopodoteuthis* and *Octopodoteuthopsis* as bioluminescent species. Both Adam (1952, 1960) and Voss (1956a) described photophores in specimens they described as *Octopoteuthis sicula* and *O. megaptera* respectively. Young (1972) was the first to find brachial photophores along the axial nerves of his new species *O. deletron*. In 1975 Lipka described brachial photophores from *Octopoteuthis* specimens in the North Atlantic.

Herring (1977) discussed bioluminescence in fish and cephalopods and presented a list of all known cephalopods bearing photophores including *Octopoteuthis*. Herring (1978a and b) again listed luminescent cephalopods and presented a table showing photophore distribution in each family.

Nearly all the photophores in *Octopoteuthis* species are directed ventrally (Young and Roper, 1977). During observations on live specimens of *Octopoteuthis nielseni* Young and Roper (1977) found that the squid could countershade themselves by using their body photophores to match the intensity of the level of light coming from an overhead light. The animals tested turned their photophores on in response to overhead illumination and reduced or turned them off when overhead light was extinguished.

5.8. Ecological and Economic Importance

While specimens of the genus *Octopoteuthis* are relatively rare in collections they have been collected from the stomachs of a large number of fish and cetacean species. Clarke (1980) has found members of the genus to account for up to 24 per cent of the buccal masses taken from sperm whale stomachs from off Durban, South Africa. Table 5-3 provides a list of predators from which *Octopoteuthis* specimens (or their beaks) have been collected and the literature reference.

It is obvious from the table that *Octopoteuthis* must play an important role as food for these predators. It should also be noted that the largest specimens we

Table 5-3: Predators from which *Octopoteuthis* specimens have been collected

PREDATOR	AUTHORITY
CETACEANS	
Physeter catadon- Sperm whale	Akimushkin, 1963; Clarke, 1966; Clarke, 1980; Clarke and MacLeod, 1976; Clarke, MacLeod and Paliza, 1976; Okutani and Sataki, 1978; Okutani *et al.*, 1976.
Hyperoodon ampullatus- Northern bottle-nosed whale	Clarke and Kristensen, 1980.
Tursiops truncatus- Bottle-nosed dolphin	Clarke, 1966; Rancurel, 1964.
FISH	
Thunnus alalunga- Albacore tuna	Bouxin and Legendre, 1932.
Thunnus thynnus- Blue-fin tuna	Data from specimens examined.
Alepisaurus ferox-	Rancurel, 1970.
Prionace glauca- Blue shark	Clarke and Stevens, 1976.

have representing the genus generally come from the stomachs of large predators (Clarke, 1980). Indeed, the largest specimen examined in this study (240 mm ML) came from the stomach of a blue-fin tuna collected in South African waters.

The genus has little commercial value at present and the high ammonium content in its tissues would certainly detract from its palatability. Tomiyama and Hibiya (1978) however listed it as being landed for use as food in Japan.

5.9. Statistical Analysis

Morphometrics have been used in taxonomic study since the late 1800's. Great emphasis has been placed on indices (ie. body measurements as a proportion of some standard body measure, most often the length of the mantle measured on the dorsum from the anterior-most point of the mantle to the posterior apex of the mantle, the mantle length) as a means to differentiate between cephalopod species. Roper and Voss (1983) call for an even greater emphasis. Little has been written however on the statistical testing of these indices and usually nothing is done other than to present their means, ranges and standard deviations.

Several authors have discussed the pros and cons of analysing derived variables, such as indices (ie. ratios), versus original measurements (Atchley *et al.*, 1976; Blackwith and Reyment, 1971; Green, 1979; Marr, 1955; and Sokal and Rolf 1969, 1973). For the most part they considered the use of ratios to be statistically poor in morphometric analyses and recommended methods such as the analysis of covariance (ANCOVA) of the original measurements. One of the main reasons for the problem is that indices change with growth and it is sometimes diffiult to get specimens of equal size.

N. Voss (1985) has managed to get around this problem and retain the use of indices by summarizing them, for selected series, over an entire available size range. This method is certainly good when applied to a large and diverse sample size but it still does not statistically test the data.

A few cephalopod workers have used statistical analyses in their work. Cohen, in her 1976 paper on the systematics of western North Atlantic species of *Loligo*, used ANCOVA in her analysis. The ANCOVA allowed analysis of the factors of sex and geographic location simultaneously and eliminated the need to have samples of equal size.

The discriminant analysis used in this present review of the genus *Octopoteuthis* ran ANCONVAs on the raw measurements of selected parameters of each of the species and recommended changes in classification based on those analyses. The growth factor was neutralized by making ML the independent variable and running all ANCOVAs against it. The discriminant analysis was, in fact, testing the usefulness of morphometrics to distinguish a priori species based the characters defined above.

The initial discriminant analysis presented an a posteriori classification including a list of what it considered as 'misclassified specimens' and a table indicating the percentages of specimens classified into each a priori species. First results indicated an average of 73.7 per cent of classified specimens as correct. One species, *O.* sp A, had a very small sample population (5) with complete variable data. As a result the covariance matrix was not of full value (ie. the analysis did not use two of the variables, eye diameter and lens diameter, of the species). *O.* sp A was therefore removed from the second discriminant analysis to see if the classification could be improved.

The second discriminant analysis resulted in an improved classification average of 78.1 percent of the original identifications correct. The overall result suggests that there is a good correlation between body measurements and the a priori defined species. One of the four species, *Octopoteuthis danae* had the highest correct classification of nearly 87 percent. The other three species *deletron*, *sicula* and *megaptera* had lower classification percentages of 77.8, 73.3 and 71.4 per cent respectively.

Based on the a priori species classification it would be expected that *sicula* would be closest to *danae* in morphometrics since they differ only by the presence or absence of accessory cusps on the arm hooks. This is supported by the high percentage of *sicula* specimens (22.2 percent) that are placed into *O. danae* by the analysis.

The discovery that morphometrics appear to be useful in separating species in this genus is surprising in a group of squids that is generally very gelatinous. The specimens examined for this study were fixed for varying durations in formalin and preserved in a variety of alcohol types (70% ethanol, 50 % isopropanol) which would be expected to produce varying shrinkage results. Certainly with the very small number of specimens (169) with complete morphometric data the measurements seem to be speceis specific.

5.10. Conclusions

From this study I conclude that:

1. There are 5 valid species of *Octopoteuthis*; 4 in the North Atlantic *sicula*, *megaptera*, *danae*, and sp A and 2 in the Pacific *deletron* and *megaptera*.

2. Species of *Octopoteuthis* may be separated using photophore patterns and hook structure making obvious therefore that intact complete specimens are necessary for proper analysis.

3. Morphometric data alone are not sufficient criteria on which to base species differentiation.

4. Discriminant analysis is encouraged as a proper statistical means to test morphometrics in a systematic paper such as this. The rate of success achieved in its use here exceeded all expectations and this technique should be used in cephalopod systematics where morphometrics and resultant indices are so heavily relied upon.

5. With the co-occurence of 4 species in the North Atlantic and two in the Pacific one would expect that further close analysis of the two species presently recognized in the Pacific, supplemented by additional collections, would indicate multiple octopoteuthid fauna there as well.

Chapter 6
REFERENCES CITED

Abbot, R. T. 1974. American Seashells-The marine mollusca of the Atlantic and Pacific coasts of North America, Van Nostrand Reinhold, Toronto, 663 pp.

Adam, W. 1937. Notes sur les Céphalopodes. **VII**. Sur un cas de régénération chez *Sepioteuthis lessoniana* Lesson, 1830. ***Bull. Mus. Roy. Hist. Nat. Belg.***, **13**(45):**1-4**.

Adam, W. 1952. Céphalopodes. Résultats scientifique Expédition océanographique Belge (1948-1949) dans les eaux côtières africaines de l'Atlantique Sud. ***Inst. roy. Scient. Belg.*****3**(3):1-142, 3 pls.

Adam, W. 1960. Les céphalopodes de l'Institut Français d'Afrique Noire. ***Bull. Inst. fr. Afr. noire***, Ser. A, **22**:465-511.

Adams, H. and A. Adams 1858. The Genera of the Recent Mollusca, **1**:1-75, pls 1-25, John Van Voorst, London.

Akimushkin, I. 1963. Cephalopods of the Seas of the U.S.S.R., 233 pp., Moscow [In Russian] (Translation by A. Mercado 223 pp., Jerusalem, 1965).

Aldrich, F. A. and M. M. Aldrich, 1968. On regeneration of the tentacular arm of the giant squid *Architeuthis dux* Steenstrup (Decapoda, Architeuthidae) *Can. J. Zool.*, **46**(5):845-847, 2 pls.

Appellöf, A. 1889. Teuthologische Beitrage. I. *Chtenopteryx* n. g., *Veranya sicula*

Krohn, *Callitéuthis* Verrill. *Bergens Mus. Arsberetn. fur 1889* (3): 1-34, 1 pl.

Atchley, W. R., C. T. Gaskins and D. Anderson 1976. Statistical properties of ratios. I. Empirical results. *Syst. Zool.*. 25:137-148.

Backus, R. H. and J. E. Craddock 1977. Pelagic faunal provinces and sound-scattering levels in the Atlantic Ocean. Pages 529-248 In: Andersen, N. R. and B. J. Zahuranec, (Eds.) Ocean sound-scattering prediction. Plenum Press, New York.

Backus, R. H., J. E. Craddock, R. L. Haedrich and B. H. Robison 1977. Atlantic mesopelagic zoogeography. *Mem. Sears. Fdn. Mar. Res.*, 1(7): 266-287.

Barnard, K. H. 1974. Contributions to the knowledge of South African marine mollusca. *Ann. S. Afr. Mus.*, 47:663-781.

Berry, S. S. 1912a. A catalogue of Japanese Cephalopoda. *Proc. Acad. Nat. Sci. Phil.*, 1912:379-444, 5 pls.

Berry, S. S. 1912b. Some necessary changes in cephalopod nomenclature. *Science*, 36(932):643-646.

Berry, S. S. 1920a. Light production in cephalopods I. *Biol. Bull.*, 38(3):141-169.

Berry, S. S. 1920b. Light production in cephalopods II. *Biol. Bull.*, 38(4):171-195.

Blackwith, R. E. and R. A. Reyment 1971. Multivariate morphometrics. Academic Press, New York, 412 pp.

Boston, R. K. 1976. Visual pigments of two species of teuthoid cephalopods, *Loligo opalescens* and *Octopoteuthis deletron*. M. A. Thesis, California State University, Fullerton, 40 pp.

Bouxin, J. and R. Legendre 1936. La faune pélagique de l'Atlantique recueillie dans des estomacs de germon au large du Golfe de Gascogne. Deuxieme Partie: Céphalopodes. *Annls. Inst. océanogr. Monaco*, **16**:1-99.

Brant, S. B. 1983. Pelagic squid associations with a warm-core ring eddy of the East Australian Current. *Aust. J. Mar. Freshw. Res.*, **34**(4):573-585.

Cairns, S. D. 1976. Cephalopods collected in the Straits of Florida by the R/V *GERDA*. *Bull. Mar. Sci.*, **26**(2):233-272.

Carus, J. V. 1889. Prodromus Faunae Mediterraneae. **2**:445-462, Stuttgart.

Chun, C. 1910. Die Cephalopoden. 1. Teil: Oegopsida. *Wiss. Ergebn. dt. Tiefsee-Exped. VALDIVIA* **18**(1):1-401, 32 figs., atlas of 61 pls, Jena, [In German] (Translation by A. Mercado, 308pp., Jerusalem, 1975).

Chun, C. 1913. Cephalopoda. *Rept. scient. Results MICHAEL SARS N. Atlant. Deep Sea Exped.* 1910, **3**(Part 1, Zoology):1-28, 2 pls.

Clarke, M. R. 1962. The identification of cephalopod beaks and the relationship between beak size and total body weight. *Bull. Brit. Mus. (nat. Hist.)*, **8**(10):421-480, 22 pls.

Clarke, M. R. 1966. A review of the systematics and ecology of oceanic squids. *Adv. Mar. Biol.*, **4**:91-300.

Clarke, M. R. 1977. Beaks, nets and numbers. *Symp. zool. Soc. London*, No. 38:89-126.

Clarke, M. R. 1980. Cephalopoda in the diet of Sperm Whales of the Southern Hemisphere and their bearing on Sperm Whale biology. *Disc. Repts.*, **37**: 1-324.

Clarke, M. R. 1983. Cephalopod biomass-estimation from predation. *Mem. Nat. Mus. Victoria*, No. 44:95-107.

Clarke, M. R., E. J. Denton and J. B. Gilpin-Brown 1969. On the buoyancy of squid of the families Histioteuthidae, Octopoteuthidae, and Chiroteuthidae. *J. Physiol., London*, **203**:49-50.

Clarke, M. R., E. J. Denton and J. B. Gilpin-Brown 1979. On the use of ammonium for buoyancy in squids. *J. mar. biol. Ass. U.K.*, **59**:259-276.

Clarke, M. R. and T. K. Kristensen 1980. Cephalopod beaks from the stomachs of two northern bottlenosed whales (*Hyperoodon ampullatus*). *J. mar. biol. Ass. U.K.*, **60**:151-156.

Clarke, M. R. and N. MacLeod 1976. Cephalopod remains from sperm whales caught off Iceland. *J. mar. biol. Ass. U.K.*, **56**:733-749.

Clarke, M. R., N. MacLeod, and O. Paliza 1976. Cephalopod remains from sperm whales caught of Peru and Chile. *J. Zool., London*, **180**:477-493.

Clarke, M. R. and J. D. Stevens 1974. Cephalopods, blue sharks and migration. *J. mar. biol. Ass. U.K.*, **54**:949-957.

Cohen, A. C. 1976. The systematics and distribution of *Loligo* (Cephalopoda, Myopsida) in the western North Atlantic, with descriptions of two new species. *Malacologia*, **15**(2):299-367.

Degner, E. 1925. Cephalopoda. *Rept. Dan. Oceanogr. Exped. 1908-1910 Medit. Adj. Seas*, **2**:1-93.

Denton, E. J. and J. B. Gilpin-Brown 1973. Floatation mechanisms in modern and fossil cephalopods. *Adv. mar. Biol.*, **11**:197-268.

Digby, B. 1949. Cephalopods from local waters at the University of Istanbul. *Nature*, **163**(4141):441.

Férussac, M. le Baron de, and A. d'Orbigny 1834-1848. Histoire naturelle générale et particuliere des céphalopodes acétabulifères vivants et fossiles. Paris, 361 pp, 144 pls.

Ficalbi, E. 1899. Una publicazione poca conoscuita di Rüppell intitola: "Intorno ad alcuni cefalopodi del mare de Messina (Messina,1844)". *Monitore Zoologico Italiano*, **10**:79-84.

Fischer, P. 1887. Manual de Conchyliologie. Paris, 1369 pp.,1138 figs., 23 pls.

Goodrich, E. S. 1892. Note on a large squid (*Ommastrephres pteropus*, Stp.). *J. mar. biol. Ass. U. K.*, **2**:314-321.

Gray, J. E. 1849. Catalogue of the Mollusca in the collection of the British Museum. I. Cephalopoda antepedia. British Museum (Nat. Hist.), London, 164pp.

Green, R. H. 1979. Sampling design and statistical methods for environmental biologists. John Wiley and Sonns, Inc., Toronto, 257 pp.

Grimpe, G. 1922. Systematische Übersicht der europaischen Cephalopoden. *Sber. naturf. Ges. Lpz., 1918-1921*, **9**:36-52.

Grimpe, G. 1925. Zur kenntnis der Cephalopoden der Nordsee. *Zool. Institut Universitat Leipzig, Wess. Meeresunter.*, **16**(3):1-124, 1 pl.

Gross, M. G. 1972. Oceanography. Prentice-Hall Canada, Ltd., Toronto, 407pp.

Hardy, A. 1965. The Open Sea: Its Natural History. Houghton Mifflin, Boston, 355 pp.

Harvey, E. N. 1952. Bioluminescence. Academic Press, New York, 649 pp.

Heppell, D. and S. M. Smith 1983. Recent Cephalopoda in the collections of the Royal Scottish Museum, Edinburgh. *Roy. Scot. Mus., Information Series, Natural History*, No. 10:1-81.

Herring, P. J. 1977. Luminescence in cephalopods and fish. *Symp.zool. Soc., London*, No. 38:127-159.

Herring, P. J. 1978a. Bioluminescence of invertebrates other than insects. In: Herring, P. J. (Ed.), Bioluminescence in Action. Academic Press, New York, 570 pp..

Herring, P. J. 1978b. Appendix: A classification of luminous organisms. In: Herring, P. J. (Ed.), Bioluminsecence in Action. Academic Press, New York, 570 pp..

Hochberg, F. G. 1983. The parasites of cephalopods: a review. *Mem. Nat. Mus. Victoria*, No. 44:109-145.

Hoyle, W. E. 1886a. A catalogue of recent Cephalopoda. *Proc. Roy. phys. Soc. Edinb.*, **9**:205-267.

Hoyle, W. E. 1886b. Report on the Cephalopoda collected by H.M.S. *CHALLENGER* during the years 1873-1876. *Rept. voy. CHALLENGER, Zool.*, **16**(44):1-245, 10 figs, 33 pls.

Hoyle, W. E. 1904. A diagnostic key to the genera of dibranchiate Cephalopoda. *Mem. Proc. Manches. Lit. Phil. Soc.*, **48**(21):1-20.

Hoyle, W. E. 1909. A catalogue of recent Cephalpoda. 2nd Supplement, 1897-1906. *Proc. Roy. phys. Soc. Edinb.*, **17**:254-299.

Hoyle, W. E. 1910. A list of Generic Names of Dibranchiate Cephalopoda with their type species. *Senckenbergiana*, **32**:407-413.

Issel, R. 1925. Contributo alla conoscenza ecologica delle larve planctoniche de Cefalopodi ("Mario Bianco" Messina, Genova). *Memorie R. Com. talassogr. ital.* No.120:1-17.

Iverson, I. L. K. and L. Pinkas 1971. A pictoral guide to beaks of certain Eastern Pacific cephalopods. *Fish. Bull.*, **152**:83-105.

Jatta, G. 1896. I. Cephalopodi viventi nel Golfo di Napoli. *Fauna und Flora Golf. Neapel*, Monogr. 23:1-268, 42 figs., 21 pls.

Johnson, C. W. 1934. List of marine mollusca of the Atlantic coast from Labrador to Texas. *Proc. Bos. Soc. Nat. Hist.*, **40**(1):1-204.

Joubin, L. 1920. Céphalopodes provenant des campagnes de la *PRINCESS-ALICE* (1898-1910). 3ᵉ Serie, *Résult. Camp. Scient., Monaco*, **54**:1-95, 16 pls.

Joubin, L. 1931. Notes preliminaires sur les céphalopodes des croisieres du *DANA* (1921-1922). 4ᵉ Serie *Annals Inst. océanogr., Monaco*, **10**:169-211.

International Commission for Zoological Nomenclature 1985. International Code for Zoological Nomenclature (Third Edition) *adopted by the* XX General Assembly of the International Union of Biological Sciences London, 338 pp.

Keferstein, W. 1866. Cephalopoda. Bronn's Klassen und Ordnungen, **3**: 1307-1500, 27 pls.

Kristensen, T. K. and J. Knudson 1983. A catalogue of the type specimens of Cephalopoda (Mollusca) in the Zoological Museum, University of Copenhagen. *Steenstrupia*, **9**(10):217-227.

Krohn, A. 1845. Ueber einen neuen Cephalopoden (*Octopoteuthis*). *Arch. Naturg.*, **11**:47-49, 1 pl.

Krohn, A. 1847. Nachtrage zu den Aufsatzen uber *Tiedmania, Octopodoteuthis,* und *Alciopa. Arch. Naturg.*, **13**:36-40, 1 pl.

Lange, M. M. 1920. On the regeneration and finer structure of the arms of the cephalopods. *J. Exp. Zool.*, **31**(1):1-40.

Laubitz, D. R., I. Sutherland and N. Sharma 1983. Index Generum. *Bibliographia Invertebratorum Aquatorium Canadensium*, **1**:56 pp.

Lea, C. E. 1978. Pelagic cephalopods of Gulf Stream cyclonic rings. M.S. Thesis, Texas A and M University, 61pp.

Lea, C. E. and J. H. Wormuth 1981. Gulf Stream cyclonic rings experiment; Pelagic cephalopod data report. Time series cruises *KNORR* 62, 65, 71, and *ENDEAVOR* 11. Texas A and M University Reference 81-4-T, 31pp.

Lipka, D. A. 1975. The systematics and zoogeography of cephalopods from the Gulf of Mexico. Ph.D. Thesis, Texas A and M University, 347pp.

Lo Bianco, S. 1909. Notizie biologiche riguardanti specialmente il periodo di maturità sessuale delgi animali del Golfo di Napoli. *Mitt. Zool. Sta. Neapel*, **19**:513-761.

Lu, C. C. and M. R. Clarke 1975. Vertical distribution of cephalopods at 11° N, 20° W in the North Atlantic. *J. mar. biol. Ass. U. K.*, **55**:369- 389.

Lu, C. C. and C. F. E. Roper 1979. Cephalopods from Deepwater Dumpsite 106 (Western Atlantic): vertical distribution and seasonal abundance. *Smithson. Contr. Zool.*, No. 288, 36 pp.

Maddock, L. and J. Z. Young 1984. Some dimensions of the angular acceleration receptor systems of cephalopods. *J. mar. biol. Ass. U. K.*, **64**:55-79.

Mangold, K. 1963. Biologie des cephalopodes benthiques et nectoniques de la Mer Catalane. *Vie et Milieu*, Suppl. 13:1-285.

Marr, J. C. 1955. The use of morphometric data in systematic, racial and relative growth studies on fishes. *Copeia*, 1:23-31.

Massy, A. 1909. The Cephalopoda Dibranchiata of the coasts of Ireland. *Sci. Invest. Fish. Branch Dept. Agric. Ireland*, **1907**(1):1-39, 3 pls.

Massy, A. 1913. Further records of the Cephalopoda Dibranchiata of the coasts of Ireland. *Sci. Invest. Fish. Branch Dept. Agric. Ireland*, **1912**(5):1- 12.

Massy, A. 1925. On the cephalopoda of the Natal Museum. *Ann. Natal Mus.*, **5**, Part 2:201-229, 4 pls.

Massy, A. 1928a. The Cephalopoda of the Irish coast. *Proc. Roy. Irish Acad.* , series B, **38**:25-37.

Massy, A. 1928b. On the cephalopoda of the Natal Museum. Part II. *Ann.Natal Mus.*, **6**, Part 1:89-96, 1 pl.

Mercer, M. C. 1968. A synopsis of the recent cephalopoda of Canada. *Proc. Symp. Mollusca, Mar. Biol. Ass., India*, **1**:265-276.

Murata, M., M. Ishii, and M. Osaka 1981. On the regeneration of tentacle of the oceanic squid, *Ommastrephes bartrami* (Lesueur). *Bull. Hokkaido Reg. Fish. Res. Lab.*, No. 46:1-14. (In Japanese with English Abstract)

Murray, J. and J. Hjort 1912. The Depths of the Ocean, MacMillan and Co., London, 321 pp, 9 pls.

Muus, B. J. 1963. Cephalopoda, suborder Teuthoidea. *Cons. Inter. pour l'Explor. Mer*, Zoopl. Sheet 97:1-5.

Naef, A. 1916. Systematische Uebersicht der mediterranen cephalopoden. *Publ. Staz. Zool. Napoli*, **1**:11-19.

Naef, A. 1921. Das System der dibranchiaten Cephalopoden und die mediterranen Arten derselben. *Mitth. Zool. Stat. Neapel*, **22**:527-542,1 fig.

Naef, A. 1923. Die Cephalopoden; Systematik. *Fauna und Flora Golf., Neapel*, Monogr. No.35, Teil 1, Band 1, Lieferung 1,2:1-863, 473 text figs., 56pls. [In German] (Translation by A. Mercado, Jerusalem, 1972, 917 pp.)

Nealson, K. H. (Ed) 1982. Bioluminescence: Current Perspectives.

Nesis, K. N. 1977. Geographic groups of pelagic cephalopods in the western tropical Pacific. *Trudy. Inst. Okeanol.*, **107**:7-44.

Nesis, K. N. 1979. The larvae of cephalopods. [In Russian], *Biolgiya Morya*, **4**:26-37.

Nesis, K. N. 1982. Short handbook Cephalopod Molluscs World Oceans, [In Russian], Light and Food Industry, Moscow, 358pp.

Okada, Y. K. 1927. Contribution à l'étude des céphalopodes lumineux. (Notes préliminaires). *Bull. Inst. Océangr. Monaco*, (494):1-16.

Okutani, T. 1966. Studies on the early life history of decapodan mollusca- II. *Bull. Tokai Reg. Fish. Res. Lab.*, No 45:61-79, 3 pls.

Okutani, T. 1967. Preliminary catalogue of decapoden Mollusca from Japanese waters. *Bull. Tokai Reg. Fish. Res. Lab.*, (50):1-16.

Okutani, T. 1973. Guide and keys to squid in Japan. *Bull. Tokai Reg. Fish. Res. Lab.*, (74):83-111.

Okutani, T. 1974. Epipelagic decapod cephalopods collected by micronekton tows during the *EASTROPAC* expedition, 1967-1968. *Bull. Tokai Reg. Fish. Res. Lab.*, (80):.

Okutani, T. and J. McGowan 1969. Systematics, distribution and abundance of the epiplanktonic squid (Cephalopoda, Decapoda) larvae of the California Current April, 1954 - March 1957. *Bull. Scripps Instit. Oceanogr.*, **14**:1-90.

Okutani, T. and Y. Sataki 1978. Squids in the diet of 38 sperm whales caught in Pacific waters off Northeastern Honshu, Japan, February 1977. *Bull. Tokai Reg. Fish. Res. Lab.*, (93):13-27, 1 pl.

Okutani, T., Y. Sataki, S. Ohsumi and T. Kawakami 1976. Squids eaten by sperm whales caught off Joban district, Japan, during January-February, 1976. *Bull. Tokai Reg. Fish. Res. Lab.*, (87):67-113, 8 pls..

Orbigny, A. d' 1834-1848. *See* Ferussac and d'Orbigny, 1834-1848.

Pearcy, W. G. 1965. Species composition and distribution of pelagic cephalopods from the Pacific Ocean off Oregon. *Pac. Sci.*, **12**(2):261-266.

Pelseneer, P. 1892. Introduction a l'etude des Mollusques. *Ann. Soc. Roy. Malac., Belg.*, **27**:31-243.

Pfeffer, G. 1884. Die cephalopoden des Hamburger Naturhistorischen Museums. *Nat. ver. Hamb. Abh.*, **8**:62-90, 3 pls..

Pfeffer, G. 1900. Synopsis der oegopsiden Cephalopoden. *Mitt. naturh. Mus. Hamb.*, **17**:147-198.

Pfeffer, G. 1908. Cephalopoden. Brandt und Apstein's *Nord. Plankton*, Issue 9:9-116, 120 figs.

Pfeffer, G. 1912. Die Cephalopoden der Plankton Expedition. *Ergebn. Atlant. Ozean Plankton exped. Humboldt-Stift.*, **2**:1-815, atlas of 48 pls.

Pierontoni, U. 1935. Gli organi luminosi e la luminescenza di *Octopoteuthis sicula* Ruppell. *Atti. Acc. Sci. Napoli*, **22**, Series 2, (3):1-11, 2 pls.

Poirier, H. 1952. Marine mollusca of the eastern coast of North America: their names and meanings. Poirier, New York, 145 pp.

Rancurel, P. 1964. Note sur la plongée profonde de *Tursiops truncatus*. *Cah. O.R.S.T.O.M. ser. Océanogr.*, **2**:135-141.

Rancurel, P. 1970. Les contenus stomacaux d'*Alepisaurus ferox* dans le sud-ouest Pacifique (Cephalopodes). *Cah. O.R.S.T.O.M. ser. Océanogr.*, **8**(4):3-87, 3 pls.

Rees, W. J. 1955. Note on the distribution of cephalopods in the eastern Mediterranean. *J. Conchyiologie*, **95**:83-85.

Robson, G. C. 1924. On the cephalopoda obtained in South African waters by Dr. J. D. F. Gilchrist in 1920-21. *Proc. Zool. Soc. London*, **39**(2): 589-686, 51 figs., 2 pls.

Robson, G. C. 1924. Preliminary report on the Cephalopoda (Decapoda) procured by the S. S. *PICKLE. S. Afr. Fish. Mar. Biol. Surv. Rept.*, **3**(Spec. Rept. 9):1-14.

Robson, G. C. 1948. The Cephalopoda decapoda of the *ARCTURUS* Oceanographic expedition, 1925. *Zoologica*, **33**(3):115-132, 18 figs.

Roeleveld, M. A. 1975. A revision of Massy's checklists of "South African" cephalopoda. *Ann. S. Afr. Mus.*, **66**, Part II:233-255.

Roper, C. F. E. 1977. Comparative captures of pelagic cephalopods by midwater trawls. *Symp. zool. Soc. Lond.*, No.38:61-87.

Roper, C. F. E. 1978. Cephalopods. In: FAO species identification sheets for fishery purposes. Western Central Atlantic (fishing area 31), edited by W. Fischer. Rome, FAO. **6**: pag. var..

Roper, C. F. E. and M. J. Sweeney 1978. A catalogue of Type-Specimens of recent Cephalopoda in the National Museum of Natural History. *Smithson. Contr. Zool.*, No.278:1-19.

Roper, C. F. E. and M. J. Sweeney 1981. Cephalopods. In: FAO species identification sheets for fishery purposes. Eastern central Atlantic, fishing areas 34, 47 (in part); edited by W. Fischer, G. Bianchi and W. B. Scott. Canada Funds in Trust, Ottawa, Department of Fisheries and Oceans Canada, by arrangement with FAO of the United Nations, **6**: pag. var..

Roper, C. F. E. and M. J. Sweeney 1983. Techniques for fixation and preservation of cephalopods. *Mem. Nat. Mus. Victoria*, No.44:28-47.

Roper, C. F. E., M. J. Sweeney and C. E. Nauen 1984. FAO species catalogue Vol. 3. Cephalopods of the world. An annotated and illustrated catalogue of species of interest to fisheries. *FAO Fish. Synop.*, **3**(125):277 pp.

Roper, C. F. E., M. J. Sweeney and M. R. Clarke, 1985. Cephalopoda. pp 117-205. In: Fischer, W. and J. C. Hureau (Eds.). FAO species identification sheets for fishery purposes. (Fishing areas 48, 58 and 88) (CCAMLR Convention Area). Prepaid and published with the support of the Commission for the Conservation of Antarctic Marine Living Resources, Rome, FAO **1**:232 pp.

Roper, C. F. E. and G. L. Voss 1983. Guidelines for taxonomic descriptions of cephalopod species. *Mem. Nat. Mus. Victoria*, No.44:48-64.

Roper, C. F. E. and R. E. Young 1975. Vertical distribution of pelagic cephalopods. *Smithson. Contr. Zool.*, No.209:1-51, 31 figs.

Roper, C. F. E., R. E. Young and G. L. Voss 1969. An illustrated key to the families of the order Teuthoidea (Cephalopoda). *Smithson. Contr. Zool.*, No.13:1-32.

Rüppell, E. 1844. Intorno ad alcuni cefalopodi del mare di Messina. *Giorn. Gabl. Messina*, 26:1-7.

SAS INST. INC. 1982. SAS User's Guide: Basics. Carey, N. C., 837 pp.

SAS INST. INC. 1982. SAS User's Guide: Satistics. Carey, N. C., 569 pp.

Sasaki, M. 1916. Notes on oegopsid cephalopods found in Japan. *Annotnes zool. jap.*, 9:89-120, 1 pl.

Sasaki, M. 1929. A monograph of the dibranchiate cephalopods of the Japanese and adjacent waters. *J. Coll. Agric. Hokkaido Imp. Univ.*, 20(Suppl. No. 20):1-357, 159 figs., 30 pls.

Silas, E. G. 1968. Cephalopoda of the West coast of India collected during the cruises of the research vessel *VARUNA* with a catalogue of the species known from the Indian Ocean. *Proc. Symp. Mollusca, Mar. Biol. Ass. India*, 1:277-358.

Sokal, R. R. and F. J. Rolf 1969. Biometry. W. H. Freeman and Co., San Francisco, 776 pp.

Sokal, R. R. and F. J. Rolf 1973. Introduction to biostatistics. W. H. Freeman and Co., San Francisco.

Stephen, A. C. 1949. The cephalopoda of Scottish and adjacent waters. *Trans. Roy. Soc. Edinb.*, **61**, Part 9:247-270.

Stephen, S.J. 1982. An annotated Checklist/Key to Cephalopods of the Canadian Atlantic. [MS] Huntsman Marine Laboratory, St. Andrews, N. B. 238 pp.

Stephen, S.J. 1985. The distribution of larvae of the genus *Octopoteuthis* Ruppell, 1844 (Cephalopoda; Teuthoidea). *Vie et Milieu*, 35(3/4):175-179.

Thiele, J. 1921. Die Cephalopoden der Deutschen Sudpolar-Expedition 1901-1903. Deutsche Sudpolar-Expedition. XVI. *Zoologie* 8:433-465, 4 pls.

Thiele, J. 1935. Handbuch der Systematischen Weichtierkunde, Gustav Fischer, Jena, 1154 pp..

Tiberi, N. 1880. Cefalopodi, Pteropodi, Eteropodi viventi nel Mediterraneo. *Bull. Soc. Malac. Ital.*, **6**: 5-49.

Toll, R. B. 1982. The comparative morphology of the gladius in the order Teuthoidea (Mollusca: Cephalopoda) in relation to systematics and phylogeny. Ph. D. Thesis, University of Miami, Miami, 390 pp.

Tomiyama, T. and T. Hibiya (Ed.) 1978. Fisheries in Japan, Squid and Cuttlefish. Japan Marine Products Photographic Materials Association, Tokyo, 161 pp..

Tryon, G. W., Jr. 1879. Manual of Conchology. Vol I. Cephalopoda. Philadelphia, 316pp., 112 pls.

Verany, J. B. 1851. Mollusques méditerranéens, observés, décrits, figurés et chromolithographiés d'après le vivant. I Céphalopodes de la Mediterranée. Gênes, 132 pp, 41pls.

Verrill, A. E. 1882. Report on cephalopods of the Northeastern coast of North America. *Rept. U. S. Commr. Fish. for 1879*. :211-455, 46 pls.

Verrill, A. E. 1885 a. Notice on the remarkable marine fauna occupying the outer banks off the southern coast of New England. *Amer. J. Sci.*, **129**;(170): 149-157.

Verrill, A. E. 1885 b. Third catalogue of mollusca recently added to the fauna of the New England Coast and adjacent parts of the Atlantic. *Trans. Conn. Acad. Arts Sci.*, **6**(2):395-452, 2 pls.

Voss, G. L. 1956a. A review of cephalopods of the Gulf of Mexico. *Bull. Mar. Sci.*, **6**(2):85-178, 18 figs.

Voss, G. L. 1956b. A checklist of the cephalopods of Florida. *Quart. J. Fla. Acad. Sci.*, **19**(4):274-282.

Voss, G. L. 1960. Bermudan cephalopods. *Fieldiana: Zoologica*, **39**(40): 419-446.

Voss, G. L. 1962. South African cephalopods. *Trans. Roy. Soc. S. Africa*, **36**(4):245-272, 1 pl.

Voss, G. L. 1963. Cephalopods of the Philippine Islands. *Bull. U.S. natn. Mus.*, **234**:1-180, 36 figs., 4 pls.

Voss, G. L. 1967. Some bathypelagic cephalopods from South African waters. *Ann. S. Afr. Mus.*, **50**:61-88.

Voss, N. A. 1969. A monograph of the Cephalopoda of the North Atlantic. The family Histioteuthidae. *Bull. Mar. Sci.*, **19**:713-867.

Voss, N. A. 1980. A generic revision of the cranchiidae (Cephalopoda; Oegopsida). *Bull. Mar. Sci.*, **30**: 365-412.

Voss, N. A. 1985. Systematics, biology and biogeography of the Cranchiid cephalopod genus *Teuthowenia* (Oegopsida). *Bull. Mar. Sci.*, **36**(1): 1-85.

Weiss, F. E. 1889. On some oigopsid cuttlefishes. *Quart. J. microsc. Sci., New Series*, **29**:75-96, 3 pls.

Wirz, K. 1958. Céphalopodes. *Faune marine des Pyrenées Orientales*,*1*: 5-59, 20 figs.

Woodward, S. P. 1871. A Manual of the Mollusca. Lockwood and Co., London, 542 pp, 23 pls..

Yamamoto, K. and T. Okutani 1975. Studies on early life history of Decapodan Mollusca-V. Systematics and distribution of epipelagic larvae of Decapod cephalopods on the South west waters of Japan during the summer in 1970. *Bull. Tokai Reg. Fish. Res. Lab.*, No. 83:45-96.

Young, R. E. 1972. The systematics and areal distribution of pelagic cephalopods from the seas off Southern California. *Smithson. Contr. Zool.*, No.97:1-157, 38 pls.

Young, R. E. 1978. Vertical distribution and photosensitive vesicles of pelagic cephalopods from Hawaiian waters. *Fish. Bull.*, **76**(3):583-615.

Young, R. E. 1981. Color of bioluminescence in pelagic organisms. In: K. H. Nealson (Ed.) Bioluminescence: Current Perspectives. pp. 72-81.

Young, R. E. and C. F. E. Roper 1969. A monograph of the cephalopoda of the North Atlantic: The Family Cycloteuthidae. *Smithson. Contr. Zool.*, No.5: 1-24, 9 pls.

Young, R. E. and C. F. E. Roper 1977. Intensity regulation of bioluminescence during countershading in living midwater animals. *Fish. Bull.*, **75**(2): 239-252.

APPENDIX 1

This following appendix lists the collection and catalogue data for each specimen by species. See materials and methods for museum, gear and collector abreviations.

Octopoteuthis sicula

--------ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE ORBIT PHOTOPHORE=0 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=1------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
6	M	2	49.0	ARG	6	41 47 --N	63 28 --W	100	EMT	10	NOV	1980	SABS	2177
9	F	2	96.0	HMA	68-4	42 56 --N	57 15 --W	300	EMT	21	NOV	1979	SABS	2177
10	F	3	100.0	HMA	65-5	44 23 --N	57 15 --W	500	EMT	20	NOV	1979	SABS	2177
11	F	3	123.0	HMA	65-5	44 23 --N	57 15 --W	500	EMT	20	NOV	1979	SABS	2177
12	F	3	100.0	HMA	65-5	44 23 --N	57 15 --W	500	EMT	20	NOV	1979	SABS	2177
13	M	3	102.0	HMA	65-5	44 23 --N	57 15 --W	500	EMT	20	NOV	1979	SABS	2177
14	M	3	120.0	HMA	65-5	44 23 --N	57 15 --W	500	EMT	20	NOV	1979	SABS	2177
15	F	3	100.0	HMA	51-5	43 38 --N	56 30 --W	500	EMT	21	NOV	1979	SABS	2177
16	M	3	130.0	HMA	51-5	43 38 --N	56 30 --W	500	EMT	21	NOV	1979	SABS	2177
17	M	3	120.0	HMA	51-5	43 38 --N	56 30 --W	500	EMT	21	NOV	1979	SABS	1979
22	F	2	38.0	ARG	85	42 40 --N	62 00 --W	500	EMT	29	NOV	1980	NMC	92474
23	M	3	111.0	HMA	55-5	42 34 --N	61 49 --W	500	EMT	18	NOV	1979	NMC	92115
24	M	2	77.0	LHA	13-3	39 00 44N	62 00 06W	300	EMT	7	FEB	1982	NMC	92484
28	M	2	68.0	LHA	14	38 59 80N	62 13 08W	300	EMT	8	FEB	1982	NMC	92485
29	M	2	75.0	LHA	14	38 59 80N	62 13 08W	300	EMT	8	FEB	1982	NMC	92485
32	F	3	100.0	HMA	70-2	42 47 --N	63 36 --W	100	EMT	25	NOV	1979	NMC	92117
33	M	2	20.0	LHA	13-1	39 00 85N	62 00 20W	50	EMT	7	FEB	1982	NMC	92482
36	M	2	26.4	SPR	5	33 05 20S	153 36 48E	0	?	22	APR	1979	MUV	F51081
37	M	2	54.0	CSI	11	40 18 --S	149 01 --E	150	EMT	18	JAN	1982	MUV	F51077
47	M	2	72.0	ANT	3/103	43 30 --S	140 -- --E	1000	IKMT	21	OCT	1968	MUV	F51073
76	?	2	30.0	?	36	?	?	0	?	--	---	----	TAMU	?
78	F	2	67.0	OCE	7862	20 28 --N	18 01 --W	200	MOC	05	NOV	1978	TAMU	?
80	M	2	26.0	GYR	8108	26 14 48	95 31 06W	210	IKMT	27	FEB	1981	TAMU	?
106	?	2	37.0	OCE	151-3	34 32 --N	75 40 --W	150	MOC	21	FEB	1979	TAMU	?
107	?	2	31.0	OCE	151-5	34 32 --N	75 40 --W	150	MOC	21	FEB	1979	TAMU	?
109	M	2	24.0	ATL	2942	9 03 --N	49 16 --W	490	IKMT	9	SEP	19743	TAMU	?
122	F	3	240.0	AFR	A1037	33 35 --S	17 10 --E	165	RMT	27	JUL	1982	SAM	?
145	F	2	36.0	REP	?	8 28 --N	84 13 --W	24	IKMT	26	MAY	1973	SBM	49452
146	F	2	28.0	GAD	25	41 57 24N	51 59 48W	100	?	28	MAY	1982	SJBS	?
147	F	2	36.0	GAD	26	41 38 12N	52 00 --W	100	?	29	MAY	1982	SJBS	?
148	F	2	38.0	GAD	26	41 38 12N	52 00 --W	100	?	29	MAY	1982	SJBS	?
149	F	2	38.0	GAD	26	41 38 12N	52 00 --W	100	?	29	MAY	1982	SJBS	?
150	M	2	36.0	GAD	26	41 38 12N	52 00 --W	100	?	29	MAY	1982	SJBS	?
151	M	2	35.0	GAD	26	41 38 12N	52 00 --W	100	?	29	MAY	1982	SJBS	?
155	F	2	36.0	GAD	32	41 17 18N	48 11 36W	100	?	30	MAY	1982	SJBS	?
157	F	2	47.0	GAD	32	41 17 18N	48 11 36W	100	?	30	MAY	1982	SJBS	?
158	F	2	36.0	GAD	32	41 17 18N	48 11 36W	100	?	30	MAY	1982	SJBS	?
159	F	2	42.0	GAD	32	41 17 18N	48 11 36W	100	?	30	MAY	1982	SJBS	?
160	F	2	34.0	GAD	32	41 17 18N	48 11 36W	100	?	30	MAY	1982	SJBS	?
161	F	2	34.0	GAD	32	41 17 18N	48 11 36W	100	?	30	MAY	1982	SJBS	?
162	M	2	52.0	GAD	32	41 17 18N	48 11 36W	100	?	30	MAY	1982	SJBS	?
163	M	2	39.0	GAD	32	41 17 18N	48 11 36W	100	?	30	MAY	1982	SJBS	?
164	M	2	36.0	GAD	32	41 17 18N	48 11 36W	100	?	30	MAY	1982	SJBS	?
165	M	2	40.0	GAD	32	41 17 18N	48 11 36W	100	?	30	MAY	1982	SJBS	?
166	M	2	35.0	GAD	32	41 17 18N	48 11 36W	100	?	30	MAY	1982	SJBS	?
167	M	2	34.0	GAD	32	41 17 18N	48 11 36W	100	?	30	MAY	1982	SJBS	?
241	F	3	145.0	WHE	490-2	?	?	0	EMT	--	APR	1971	USNM	?
284	F	2	46.0	CHA	1520	38 56 --N	69 32 --W	35	?	30	AUG	1967	USNM	00814602
340	M	3	178.0	DEL	12-18	32 09 --N	64 11 --W	750	EMT	24	AUG	1971	USNM	00728875

Octopoteuthis sicula

--------ABDOMINAL PHOTOPHORE=2   ANTERIOR EYE ORBIT PHOTOPHORE=0   EYEBALL PHOTOPHORE=0   ACCESSORY HOOK CUSPS=1--------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
341	M	3	170.0	DEL	12-01	64 11 --W	64 11 --W	750	EMT	24	AUG	1971	USNM	00728875
345	F	2	36.0	JOA	2	?		0	?	--	---	----	USNM	00294851
348	M	2	31.0	SAN	10-4-	32 18 --N	64 12 --W	800	IKMT	2	JUN	1970	USNM	00728035
351	F	2	35.0	ALB	74-5	?	?	0	MWT	--	---	----	USNM	00730364
352	F	2	35.0	ALB	74-5	?	?	0	MWT	--	---	----	USNM	00730364
354	M	3	72.0	LHA	1-4	42 40 --N	62 57 --W	750	EMT	3	FEB	1982	IMPD	?
361	F	3	105.0	HMA	20-5	42 15 --N	63 07 --W	500	MWT	25	NOV	1979	IMPD	?
362	F	3	115.0	HMA	20-5	42 15 --N	63 07 --W	500	MWT	25	NOV	1979	IMPD	?
363	F	2	50.0	HMA	20-5	42 15 --N	63 07 --W	500	MWT	25	NOV	1979	IMPD	?
364	M	3	125.0	HMA	20-5	42 15 --N	63 07 --N	500	MWT	25	NOV	1979	IMPD	?
365	M	3	111.0	HMA	20-5	42 15 --N	63 07 --W	500	MWT	25	NOV	1979	IMPD	?
366	M	2	57.0	HMA	20-5	42 15 --N	63 07 --W	500	MWT	25	NOV	1979	IMPD	?
372	F	2	65.0	HMA	57-3	42 55 --N	60 40 --W	300	MT	23	NOV	1979	IMPD	?
373	F	3	183.0	HMA	59-5	43 37 --N	59 37 --W	500	EMT	19	NOV	1979	IMPD	H7299
375	M	3	125.0	HMA	59-5	43 37 --N	59 37 --W	500	EMT	19	NOV	1979	IMPD	H7299
376	M	3	117.0	HMA	59-5	43 37 --N	59 37 --W	500	EMT	19	NOV	1979	IMPD	H7299
377	M	3	117.0	HMA	59-5	43 37 --N	59 37 --W	500	EMT	19	NOV	1979	IMPD	H7299
388	?	2	75.0	BEL	20-5	42 16 --N	63 06 --W	500	EMT	23	MAR	1979	IMPD	?
389	F	3	132.0	HMA	60-5	43 20 --N	59 27 --W	500	MWT	19	NOV	1979	IMPD	?
456	?	2	28.3			38 11 --N	15 33 --E					1905	RSM	1903.48.9

Octopoteuthis sicula ??

------ABDOMINAL PHOTOPHORE=2   ANTERIOR EYE ORBIT PHOTOPHORE=0   EYEBALL PHOTOPHORE=9   ACCESSORY HOOK CUSPS=1--------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
42	F	3	220	HAL	?	38 35 --S	141 45 --E	1050	?	4	AUG	1982	MUV	F51079
244	F	3	168	WHE	367-I	?	?	0	EMT	--	MAR	1971	USNM	?

Octopoteuthis megaptera

--------ABDOMINAL PHOTOPHORE=2   ANTERIOR EYE ORBIT PHOTOPHORE=1   EYEBALL PHOTOPHORE=1   ACCESSORY HOOK CUSPS=1--------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
5	F	2	61.0	ARG	36	38 11 --N	65 11 --W	100	EMT	10	NOV	1980	SABS	2177
7	F	2	55.0	HMA	22-4	42 16 --W	61 28 --W	400	EMT	18	NOV	1979	SABS	2177
8	M	3	101.0	HMA	22-4	42 16 --N	61 28 --W	300	EMT	18	NOV	1979	SABS	2177
25	M	2	37.0	BEL	79-2	40 53 48N	62 20 30W	100	EMT	15	MAY	1977	NMC	92108
38	M	2	43.0	CSI	11	40 18 --S	149 01 --E	150	EMT	18	JAN	1982	MUV	F51077
39	M	2	41.0	CSI	11	40 18 --S	149 01 --E	150	EMT	18	JAN	1982	MUV	F51077
43	F	2	37.0	SOE	?	38 08 30S	150 14 00E	70	EMT	20	NOV	1981	MUV	F51075
44	M	2	39.0	COU	?	36 04 --S	152 50 --E	150	?	3	DEC	1978	MUV	F51071

Octopoteuthis megaptera

------ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=1 ACCESSORY HOOK CUSPS=1------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MU	CATNO
45	F	2	42.0	SPR	8	33 04 20S	154 06 54E	0	?	22	SEP	1979	MUV	F51082
46	F	3	76.0	SPR	8	33 04 20S	154 06 54E	0	?	22	SEP	1979	MUV	F51082
48	F	2	57.0	SOE	80/23	37 39 --S	150 13 --E	250	IGYP	2	FEB	1980	MUV	F51076
49	F	2	41.0	SOE	81/4	37 57 24S	150 14 24E	600	?	19	NOV	1981	MUV	F51074
50	F	2	49.0	TAI	19	37 37 --S	150 15 --E	150	MT	19	JAN	1982	MUV	F51080
56	M	2	68.0	WHE	4	37 22 --N	13 42 --W	0	?	19	JAN	1968	ZMUH	?
58	F	3	180.0	WHE	23	23 20 --S	33 20 --W	0	?	--	FEB	1968	ZMUH	?
59	F	3	152.0	WHE	19	9 43 --S	27 07 --W	0	?	5	FEB	1968	ZMUH	?
60	F	3	113.0	WHE	17	4 43 --S	29 39 --W	0	?	4	FEB	1968	ZMUH	?
63	M	3	100.0	WHE	194	27 57 --S	40 52 --W	0	?	27	MAY	1966	ZMUH	?
65	M	3	90.0	WHE	11	16 14 --N	22 24 --W	0	?	29	JAN	1968	ZMUH	?
66	M	2	43.0	WHE	28	34 00 --S	47 34 -- W	0	?	4	FEB	1968	ZMUH	?
67	M	3	134.0	WHE	193	25 27 --S	36 56 --W	0	?	26	MAY	1966	ZMUH	?
68	F	3	137.0	WHE	188	9 41 --S	27 39 --W	0	?	21	MAY	1966	ZMUH	?
70	M	3	91.0	WHE	13	8 29 --N	24 07 --W	0	?	31	JAN	1968	ZMUH	?
84	M	2	38.0	KNO	11	38 28 --N	72 34 --W	250	MOC	31	AUG	1976	TAMU	?
85	M	3	79.0	OCE	7741	8 33 --N	44 37 --W	100	MOC	24	JUL	1977	TAMU	?
108	M	2	36.0	ATL	2927	10 59 --N	42 09 --W	450	IKMT	17	SEP	1973	TAMU	?
110	F	2	68.0	ATL	2976	13 29 --N	52 57 --W	580	IKMT	28	SEP	1973	TAMU	?
111	?	2	37.0	ATL	2976	13 29 --N	52 57 --W	450	IKMT	8	OCT	1973	TAMU	?
116	M	2	36.0	ALA	14-1	26 17 --N	94 50 --W	1250	MWT	2	OCT	1965	TAMU	4-2334
126	M	2	44.0	DSF	A2962	39 06 --S	13 34 --E	600	IKMT	23	MAR	1969	SAM	S146
127	F	2	46.5	AFR	A2082	29 21 --S	13 08 54E	50	RMT	--	---	1982	SAM	S1051
128	M	2	46.0	AFR	A2070	29 27 --S	14 14 --E	25	RMT	16	AUG	1982	SAM	?
129	F	2	48.0	NAU	SM218	32 30 48S	29 13 24E	916	RMT	23	JUN	1979	SAM	S271
130	M	2	33.0	NAU	SM218	32 30 48S	29 13 24E	916	RMT	23	JUN	1979	SAM	S271
131	M	2	33.0	DSF	A2391	48 58 48S	21 59 00E	820	N-B	7	APR	1963	SAM	S316
132	M	2	48.0	NAU	SM148	30 17 06S	31 25 12E	0	RMT	17	MAY	1977	SAM	S196
168	F	2	70.0	GAD	31	40 08 06N	55 57 30W	0	SPUT	24	FEB	1981	SJBS	08880
169	M	2	80.0	GAD	31	40 08 06N	55 57 30W	0	SPUT	24	FEB	1981	SJBS	08880
170	M	2	66.0	GAD	31	40 08 06N	55 57 30W	0	SPUT	24	FEB	1981	SJBS	08880
174	F	3	160.0		?	DONKERGAT,	S. AFRICA	0	FWS	29	SEP	1963	BMNH	1973100
178	M	3	147.0	?	?	DONKERGAT,	S. AFRICA	0	?	29	SEP	1963	BMNH	1973101
191	F	2	140.0	?	?	22 04 --S	63 02 --E	2000	MWT	12	DEC	1960	SIO	61-36
193	M	3	163.0	CLI	?	28 36 --N	157 52 --W	1000	IKMT	28	SEP	1968	SIO	?
197	M	2	91.0	?	620	30 00 --N	120 07 --W	2000	IKMT	13	APR	1962	SIO	?
210	F	2	36.0	WHE	482-2	4 36 --N	19 40 --W	256	EMT	13	APR	1971	USNM	294756
211	F	2	31.0	WHE	482-2	4 36 --N	19 40 --W	256	EMT	13	APR	1971	USNM	294756
212	M	3	106.0	WHE	482-2	4 36 --N	19 40 --W	256	EMT	13	APR	1971	USNM	294756
219	F	2	97.0	WHE	498-2	17 24 --N	22 57 --W	305	EMT	17	APR	1971	USNM	294756
221	F	2	86.0	WHE	482-I	4 34 --N	19 39 --W	104	EMT	13	APR	1971	USNM	294756
222	F	2	86.0	WHE	482-I	4 34 --N	19 39 --W	104	EMT	13	APR	1971	USNM	294756
223	?	2	119.0	WHE	482-I	4 34 --N	19 39 --W	104	EMT	13	APR	1971	USNM	294756
224	?	2	103.0	WHE	482-I	4 34 --N	19 39 --W	104	EMT	13	APR	1971	USNM	294756
225	F	2	112.0	WHE	455-2	13 07 --S	9 02 --W	1010	EMT	6	APR	1971	USNM	294756
228	M	2	82.0	WHE	417-I	34 12 --S	16 35 --E	1550	EMT	28	MAR	1971	USNM	204756
229	M	2	36.0	WHE	350-2	38 38 --S	52 02 --W	262	EMT	5	MAR	1971	USNM	294756
230	F	3	126.0	WHE	363-2	40 18 --S	39 12 --W	328	EMT	8	MAR	1971	USNM	?
234	F	2	38.0	WHE	482-I	4 34 --N	19 39 --W	104	EMT	13	APR	1971	USNM	?

Octopoteuthis megaptera

-----ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=1 ACCESSORY HOOK CUSPS=1-----------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
235	F	2	38.0	WHE	482-I	04 34 --N	19 39 --W	104	EMT	13	APR	1971	USNM	?
236	F	3	82.0	WHE	419-I	34 25 --S	14 47 --E	112	EMT	28	MAR	1971	USNM	?
237	F	2	59.0	WHE	419-I	34 25 --S	14 47 --E	112	EMT	28	MAR	1971	USNM	?
238	F	2	75.0	WHE	419	34 25 --S	14 47 --E	112	EMT	28	MAR	1971	USNM	?
239	F	2	43.0	WHE	419-I	34 25 --S	14 47 --E	112	EMT	28	MAR	1971	USNM	?
240	F	2	39.0	WHE	419-I	34 25 --S	14 47 --E	112	EMT	28	MAR	1971	USNM	?
246	F	3	110.0	WHE	498-I	17 22 --N	22 58 --W	105	EMT	17	APR	1971	USNM	?
369	F	3	151.0	WHE	467-7	5 30 --S	16 28 --W	1400	EMT	9	APR	1971	USNM	00730682
397	M	3	111.0	DAN	3946	3 26 --S	42 58 --E	300	S200	3	JAN	1920	ZMUC	?
398	M	3	90.0	GAL	268	4 14 --S	54 28 --E	4046	TOT	28	MAR	1951	ZMUC	?
399	M	2	51.0	DAN	3804	9 09 --S	114 47 --E	1000	E300	30	AUG	1929	ZMUC	?
401	M	2	49.0	DAN	3929	12 11 --S	50 18 --E	600	S200	18	DEC	1929	ZMUC	?

Octopoteuthis megaptera ??

--------ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=9 ACCESSORY HOOK CUSPS=1-------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
137	F	3	128	ADM	?	40 49 --N	124 28 --W	247	OTT	1	OCT	1969	SBM	40834
138	M	3	120	ADM	?	40 49 --N	124 28 --W	247	OTT	1	OCT	1969	SBM	40834
247	F	3	158	WHE	423-7	35 22 --S	10 36 --E	305	EMT	29	MAR	1971	USNM	?
270	F	3	113	ATL	2086	18 29 --N	29 13 --W	155	IKMT	26	NOV	1970	USNM	00814610
273	M	3	102	CRO	47-10	3 13 --S	145 23 --W	150	COOB	14	FEB	1970	USNM	00814607
274	F	3	143	CRO	32-28	20 58 --N	158 33 --W	122	COBB	25	JUL	1967	USNM	00814608
275	M	3	121	GIL	89-11	6 04 --S	157 36 --W	200	NAN	2	FEB	1966	USNM	00814609
281	M	2	41	CRO	32-31	20 59 --N	158 29 --W	121	COBB	13	AUG	1967	USNM	00814600
285	F	2	40	SMI	47-8	21 32 --N	158 22 --W	550	NAN	19	OCT	1958	USNM	00814603
286	F	2	50	SMI	47-8	21 32 --N	158 22 --W	550	NAN	19	OCT	1958	USNM	00814603
289	F	3	71	CLA	71-2-	21 25 --N	158 25 --W	160	IKMT	27	FEB	1971	USNM	00730762
301	M	2	43	?	77	?	?	0	IKMT	--	---	----	USNM	00815744
349	M	2	43	ALB	74-5	?	?	0	MWT	--	---	----	USNM	00730363
350	M	2	46	ALB	74-5	?	?	0	MWT	--	---	----	USNM	00730363
355	M	3	127	LHA	24-4	41 30 --N	60 58 --W	500	EMT	16	FEB	1982	IMPD	?
368	F	2	40	ORE	?	29 10 --N	87 55 --W	200	FLT	12	JUN	1953	USNM	00575124

------ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=1 ACCESSORY HOOK CUSPS=0-------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
1	M	2	59	HMA	22-2	42 16 --N	61 30 --W	100	EMT	18	NOV	1979	SABS	2177

------ABDOMINAL PHOTOPHORE=0 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=1 ACCESSORY HOOK CUSPS=1-------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
74	?	2	0	WHE	188	9 41 --S	27 39 --W	0	?	21	MAY	1966	ZMUH	?
231	?	3	0	WHE	363-2	40 18 --S	39 12 --W	328	EMT	8	MAR	1971	USNM	?

Octopoteuthis danae

------ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE ORBIT PHOTOPHORE=0 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=0------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
2	M	2	65	ATC	5	42 15 72N	62 35 19W	500	EMT	31	JAN	1981	SABS	2177
4	M	2	54	HMA	20-2	42 15 --N	63 05 --W	100	EMT	25	NOV	1979	SABS	2177
18	F	2	75	LHA	49-1	39 20 27N	59 68 60W	300	EMT	22	FEB	1982	NMC	92486
19	M	2	60	LHA	49-1	39 20 27N	59 68 60W	300	EMT	22	FEB	1982	NMC	92486
30	M	2	58	ARG	84	42 40 --N	62 10 --W	0	EMT	29	NOV	1980	NMC	92489
31	M	2	48	HMA	57-2	42 55 --N	60 43 --W	100	EMT	23	NOV	1979	NMC	92135
79	F	2	68	OCE	7867	14 52 --N	18 13 --W	441	MOC	8	NOV	1978	TAMU	?
99	F	2	63	KNO	401	39 40 --N	70 33 --W	995	IKMT	23	NOV	1973	TAMU	?
117	F	2	35	ALA	3	27 17 --N	89 59 --W	980	MWT	16	JUL	1965	TAMU	4-2335
152	F	2	37	GAD	24	42 06 54N	52 00 00W	100	EMT	28	MAY	1982	SJBS	?
217	F	2	29	WHE	490-I	?	?	0	EMT	--	APR	1971	USNM	?
343	F	2	34	DEL	12-70	32 22 --N	64 04 --W	100	EMT	22	AUG	1971	USNM	?
353	M	3	64	LHA	26-4	40 28 --N	61 02 --W	500	EMT	16	FEB	1982	IMPD	?
356	F	3	107	HMA	22-5	42 15 --N	61 21 --W	500	MWT	16	NOV	1969	IMRD	?
358	F	2	57	LHA	20-3	42 00 --N	61 59 --W	300	EMT	10	FEB	1982	IMPD	?
359	M	2	47	LHA	20-3	42 00 --N	61 59 --W	300	EMT	10	FEB	1982	IMPD	?
360	M	2	57	LHA	20-3	42 00 --N	61 59 --W	300	EMT	10	FEB	1982	IMPD	?
371	M	2	52	LHA	3-2	41 29 --N	62 59 --W	100	EMT	4	FEB	1982	IMPD	?
378	M	2	58	HMA	68-2	42 55 --N	57 13 --W	200	?	21	NOV	1979	IMPD	?
379	M	2	81	LHA	3-4	41 31 --N	63 00 --W	0	?	4	FEB	1982	IMPD	?
380	M	2	60	LHA	20-2	42 00 --N	61 59 --W	0	EMT	9	FEB	1982	IMPD	?
381	F	2	69	LHA	27-0	39 57 --N	61 03 --W	0	EMT	17	FEB	1982	IMPD	?
382	M	2	69	LHA	48-1	39 19 --N	59 43 --W	0	EMT	22	FEB	1982	IMPD	?
383	F	2	57	LHA	48-1	39 19 --N	59 43 --W	0	EMT	22	FEB	1982	IMPD	?
384	M	2	62	LHA	59-3	42 03 --N	60 01 --W	0	EMT	23	FEB	1982	IMPD	?
385	M	2	60	BEL	53	42 13 --N	54 52 30W	500	EMT	12	APR	1979	IMPD	?
387	M	2	76	LHA	39-1	38 51 --N	60 44 --W	0	EMT	19	FEB	1982	IMPD	?
390	M	2	102	BEL	47-5	40 58 --N	55 00 --W	500	EMT	9	APR	1979	IMPD	?
392	?	2	35	BEL	79-3	48 53 48N	62 20 30W	200	EMT	19	MAY	1979	IMPD	?
393	F	2	35	GAL	601	45 51 --S	164 32 --E	4510	?	14	JAN	1952	ZMUC	?
400	F	2	38	GAL	574	39 45 --S	159 39 --E	4850	ST6	18	DEC	1951	ZMUC	?
403	F	2	32	DAN	1341	33 15 --N	68 20 --W	150	S200	14	MAY	1922	ZMUC	?

Octopoteuthis deletron

------ABDOMINAL PHOTOPHORE=1 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=1------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
34	F	3	97	JWS	36	31 29 30N	131 03 --W	0	?	9	JUL	1965	NMC	76526
35	M	3	105	JWS	36	31 29 30N	131 03 --W	0	?	9	JUL	1965	NMC	76526
118	M	3	100	VEL	8716	33 15 --N	118 37 --W	925	MWD	7	JUL	1963	AHF	C-TYPE#3
135	F	3	192	?	?	?	?	350	?	4	OCT	1966	SBM	45980
141	F	2	46	?	?	?	?	1024	?	30	OCT	1968	SBM	458400
142	M	2	42	?	?	?	?	1027	?	30	OCT	1968	SBM	458400
143	F	2	60	SWA	?	?	?	0	?	18	APR	1964	SBM	46002

Octopoteuthis deletron

-------ABDOMINAL PHOTOPHORE=1   ANTERIOR EYE ORBIT PHOTOPHORE=1   EYEBALL PHOTOPHORE=0   ACCESSORY HOOK CUSPS=1-------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
144	F	2	43	?	?	34 20 --N	120 -- --W	0	?	4	AUG	1965	SBM	46000
172	F	2	79	?	?	NO RT H	PA CI FIC	0	?	12	APR	1968	SJBS	?
173	M	2	61	?	?	NO RT H	PA CI FIC	0	?	12	APR	1968	SJBS	?
183	M	2	47	MV	?	40 35 13N	125 52 30W	3000	?	21	MAY	1966	SIO	66-51
184	F	2	54	MV	66II5	38 02 14N	124 11 02W	5500	?	24	MAY	1966	SIO	66-53
185	F	2	51	SPE	?	37 28 --N	128 18 --W	0	IKMT	15	APR	1957	SIO	?
186	F	2	/0	ALA	?	32 10 --N	117 14 --W	274	MWT	31	JAN	1970	SIO	?
187	M	2	47	ALA	?	32 10 --N	117 14 --W	274	MWT	31	JAN	1970	SIO	?
188	M	3	144	ALA	?	32 10 --N	117 14 --W	274	MWT	31	JAN	1970	SIO	?
192	F	3	172	WAS	?	38 20 30W	124 04 03W	4500	IKMT	16	JUN	1967	SIO	67-117
194	F	3	134	HUB	397	32 43 --N	117 37 --W	1043	IKMT	3	NOV	1951	SIO	?
195	F	2	48	MV	II-19	36 33 --N	122 12 --W	2250	IKMT	12	JUN	1967	SIO	?
196	M	3	144	MV	II-19	36 33 --N	122 12 --W	2250	IKMT	12	JUN	1967	SIO	?
199	F	2	27	MV	66-II	32 11 --N	117 21 ---	2000	IKMT	7	DEC	1966	SIO	?
201	F	2	0	AGA	90.14	30 11 --N	124 27 --W	0	IKMT	5	SEP	1970	SIO	74-25
202	F	2	44	?	?	32 34 --N	117 35 --W	768	MWT	26	NOV	1951	SIO	?
203	F	2	40	DAV	2	CAT ISLAND	LA BIGHT	0	?	9	OCT	1968	SIO	?
204	F	2	32	DSJ	2	CAT ISLAND	LA BIGHT	0	?	9	OCT	1968	SIO	?
205	M	2	31	DSJ	2	CAT ISLAND	LA BIGHT	0	?	9	OCT	1968	SIO	?
206	F	2	42	MV	66III	32 05 --N	119 57 --W	2000	MWD	12	DEC	1966	SIO	?
207	F	2	29	MV	66III	32 05 --N	119 57 --W	2000	MWD	12	DEC	1966	SIO	?
300	F	2	34	VEL	B025	33 16 --N	118 36 --W	563	IKMT	7	AUG	1962	USNM	00727483

Octopoteuthis deletron ??

------ABDOMINAL PHOTOPHORE=1   ANTERIOR EYE ORBIT PHOTOPHORE=1   EYEBALL PHOTOPHORE=9   ACCESSORY HOOK CUSPS=1-------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
139	F	3	161	?	3	?	?	15	?	10	APR	1973	SBM	?

------ABDOMINAL PHOTOPHORE=1   ANTERIOR EYE ORBIT PHOTOPHORE=9   EYEBALL PHOTOPHORE=9   ACCESSORY HOOK CUSPS=1-------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
190	?	2	80	CHU	?	32 30 --N	117 27 --W	860	IKMT	1	NOV	1963	SIO	63-873

Octopoteuthis sp. A

--------ABDOMINAL PHOTOPHORE=1 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=0--------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
57	?	2	31	WHE	179	27 30 --N	18 48 --W	0	?	--	MAY	1966	ZMUH	?
62	M	2	105	WHE	180	23 30 --N	20 08 --W	0	?	13	MAY	1966	ZMUH	?
64	M	2	66	WHE	?	?	?	0	?	?			ZMUH	?
69	F	2	116	WHE	6	32 31 --N	16 54 --W	0	?	21	JAN	1968	ZMUH	?
243	M	3	67	WHE	431-3	30 04 --S	5 22 --E	502	EMT	31	MAR	1971	USNM	?
250	F	3	152	WHE	431-3	30 04 --S	5 22 --E	500	EMT	31	MAR	1971	USNM	00730684
251	M	3	170	WHE	431-3	30 04 --S	5 22 --E	500	EMT	31	MAR	1971	USNM	00730684
255	M	3	87	DEL	12-63	32 11 --[illegible]	64 00 --W	780	EMT	22	AUG	1971	USNM	00728852
266	M	2	69	ALB	7-9-N	32 09 --[illegible]	63 45 --W	250	IKMT	7	SEP	1967	USNM	00726966
277	M	2	84	ATL	2090	22 06 --N	32 45 --W	255	IKMT	29	NOV	1970	USNM	00814605
290	M	3	116	DEL	17-79	32 08 --N	64 09 --W	450	EMT	23	AUG	1971	USNM	00728853
291	F	3	150	DEL	12-72	32 08--N	4 14 --W	760	EMT	23	AUG	1971	USNM	00728851
307	M	3	93	VEL	11168	31 40 --N	120 06 --W	406	IKMT	31	JUL	1966	USNM	00727461

Octopoteuthis sp A ??

-------ABDOMINAL PHOTOPHORE=1 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=9 ACCESSORY HOOK CUSPS=0--------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
294	M	3	175	DEL	12-80	32 19 --N	64 11 --W	750	EMT	24	AUG	1971	USNM	00728848
295	M	3	176	DEL	12-67	32 04 --N	63 58 --W	1025	EMT	22	AUG	1971	USNM	00728847
296	M	3	100	DEL	12-67	32 04 --N	63 58 --W	1025	EMT	22	AUG	1971	USNM	00728847

Octopoteuthis sp

-------ABDOMINAL PHOTOPHORE=0 ANTERIOR EYE ORBIT PHOTOPHORE=0 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=0--------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
53	?	2	32.5	?	?	38 11 --N	15 34 --E	0	?	--	---	----	ZMUB	2950
82	F	2	24.3	KNO	27-2	36 46 --N	69 30 --W	1075	MOC	17	APR	1977	TAMU	?
86	?	2	35.0	OCE	7745	9 15 --N	46 46 --W	100	MOC	25	JUL	1977	TAMU	?
96	?	2	19.8	KNO	34-4	36 72 --N	56 41 --W	0	MOC	24	APR	1977	TAMU	?
154	?	2	22.0	GAD	33	41 22 12N	47 14 24W	100	EMT	30	MAY	1982	SJBS	?
208	F	2	27.0	AGA	90.90	31 24 --N	121 59 --W	1000	MWO	9	SEP	1970	SIO	74-29
209	M	2	27.0	?	90.90	31 24 --N	121 59 --W	1000	MWO	9	SEP	1970	SIO	74-29
269	F	2	35.0	ALB	7-15-	32 21 --N	63 29 --W	450	IKMT	8	SEP	1069	USNM	00726962
357	?	2	65.0	HMA	22-5	42 15 --N	61 21 --W	500	MWT	16	NOV	1979	IMPD	?
391	?	3	0.0	BEL	23-6	41 31 --N	60 46 --W	0	EMT	24	MAR	1979	IMPD	?
394	F	2	34.0	?	?	OFF MESSIN	, ITALY	0	?	13	MAY	1893	ZMUC	?

Octopoteuthis sp

-------ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE ORBIT PHOTOPHORE=9 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=1-------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
242	?	2	53	WHE	419-2	34 26 --S	14 43 --E	305	EMT	28	MAR	1971	USNM	?

-------ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE ORBIT PHOTOPHORE=9 EYEBALL PHOTOPHORE=9 ACCESSORY HOOK CUSPS=0-------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
27	F	2	46	ARO	49	43 38 --N	57 55 --W	300	EMT	17	NOV	1980	NMC	92481
136	M	3	146	VEL	3	10 17 --N	87 46 --W	1000	MWT	?			SBM	51337
153	M	2	65	GAD	11	?	?	200	SPUT	24	FEB	1982	SJBS	?
176	F	2	100	?	?	?	?	161	?	---	---	----	BMNH	19091127
180	M	2	43	EAS	12260	11 09 --N	111 57 --W	300	MWO	18	MAR	1967	SIO	?
215	F	2	70	WHE	490-I	?	?	0	EMT	---	APR	1971	USNM	?
216	F	2	46	WHE	490-I	?	?	0	EMT	---	APR	1971	USNM	?
278	F	2	86	ATL	2045	20 07 --N	18 15 --W	200	IKMT	12	NOV	1970	USNM	00814606

-------ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE ORBIT PHOTOPHORE=9 EYEBALL PHOTOPHORE=9 ACCESSORY HOOK CUSPS=1-------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
21	F	2	80.0	BEL	22-5	46 16 --N	62 00 --W	500	EMT	24	MAR	1981	NMC	92082
123	F	3	215.0			3 41 --S	7 29 --E	0	FBS	14	MAY	1984	SAM	?
125	F	3	102.6	SFI	8208	31 27 --S	6 37 48E	306	?	23	AUG	1982	SAM	S987
276	M	2	65.0	CRO	9	OFF	HAWAII	0	?	9	SEP	1970	USNM	00814604
297	F	3	163.0	WHE	474-7	?		0	?	---	---	1971	USNM	00294756

-------ABDOMINAL PHOTOPHORE=1 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=1 ACCESSORY HOOK CUSPS=1-------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
292	F	2	35	DEL	12-72	32 25 --N	64 14 --W	760	EMT	23	AUG	1971	USNM	00728851

-------ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=0-------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
3	M	2	70	BEL	49-4	42 02 --N	56 15 --W	300	EMT	10	APR	1979	SABS	2177
189	M	2	94	WIO	?	29 15 --N	126 07 --W	750	?	14	MAY	1955	SIO	57-87
283	?	2	36	CRO	32-37	20 59 --N	158 12 --W	123	COBB	15	AUG	1967	USNM	00814601
402	F	2	36	GAL	237	3 18 --S	45 18 --E	4780	?	12	MAR	1951	ZMUC	?

Octopoteuthis sp

--------ABDOMINAL PHOTOPHORE=0   ANTERIOR EYE ORBIT PHOTOPHORE=0   EYEBALL PHOTOPHORE=0   ACCESSORY HOOK CUSPS=1--------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
75	?	2	27.3	OCE	112-3	34 23 --N	75 37 --W	100	MOC	12	AUG	1978	TAMU	?
97	?	2	18.2	KNO	25-2	34 27 --N	71 18 --W	1050	MOC	13	APR	1977	TAMU	?
181	F	2	32.0	?	90.90	31 24 --N	122 01 --W	1000	MWO	8	SEP	1970	SIO	74-28
182	?	2	23.0	?	?	9 54 --N	98 40 --W	750	?	7	MAY	1980	SIO	?
279	F	2	30.0	CRO	46-17	11 53 --N	144 48 --W	50	?	18	OCT	1969	USNM	00814598
374	F	3	125.0	HMA	59-5	43 37 --N	59 37 --W	500	EMT	19	NOV	1979	IMPD	H7299
386	M	2	93.0	BEL	51	43 38 12N	56 32 --W	200	EMT	11	APR	1979	IMPD	?

------ABDOMINAL PHOTOPHORE=0   ANTERIOR EYE ORBIT PHOTOPHORE=0   EYEBALL PHOTOPHORE=1   ACCESSORY HOOK CUSPS=0--------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
156	F	2	37	GAD	32	41 17 18N	48 11 36W	100	?	30	MAY	1982	SJBS	?

------ABDOMINAL PHOTOPHORE=0   ANTERIOR EYE ORBIT PHOTOPHORE=1   EYEBALL PHOTOPHORE=0   ACCESSORY HOOK CUSPS=0--------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
299	M	3	155	WHE	447-3	?	?	0	?	--	---	1971	USNM	?

------ABDOMINAL PHOTOPHORE=0   ANTERIOR EYE ORBIT PHOTOPHORE=1   EYEBALL PHOTOPHORE=0   ACCESSORY HOOK CUSPS=1--------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
305	F	2	51	ORE	3250	29 14 --N	87 40 --W	0	MWT	26	APR	1961	USNM	00575596
306	M	2	43	ORE	3250	29 14 --N	87 40 --W	800	MWT	26	APR	1961	USNM	00575596

-------ABDOMINAL PHOTOPHORE=0   ANTERIOR EYE ORBIT PHOTOPHORE=9   EYEBALL PHOTOPHORE=0   ACCESSORY HOOK CUSPS=1--------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
293	M	3	175	DEL	12-72	32 25 --N	64 14 --W	760	EMT	23	AUG	1971	USNM	00728851

------ABDOMINAL PHOTOPHORE=0   ANTERIOR EYE ORBIT PHOTOPHORE=9   EYEBALL PHOTOPHORE=9   ACCESSORY HOOK CUSPS=0--------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
26	F	2	60	LHA	27-3	39 56 03N	61 06 37W	300	EMT	17	FEB	1982	NMC	92476
218	M	3	120	WHE	494-7	?	?	0	EMT	---	APR	1971	USNM	?

Octopoteuthis sp

------ABDOMINAL PHOTOPHORE=0 ANTERIOR EYE ORBIT PHOTOPHORE=9 EYEBALL PHOTOPHORE=9 ACCESSORY HOOK CUSPS=1------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
20	F	3	165	HMA	18-2	41 28 --N	62 21 --W	100	MWT	24	NOV	1979	NMC	92112
226	F	3	148	WHE	502-7	?	?	0	EMT	--	APR	1971	USNM	?
227	M	2	53	WHE	486-7	?	?	0	EMT	--	APR	1971	USNM	?
232	F	2	78	WHE	402-2	?	?	0	EMT	--	MAR	1971	USNM	?
233	F	2	40	WHE	402-2	?	?	0	EMT	--	MAR	1971	USNM	?
248	M	3	183	WHE	402-3	?	?	0	EMT	--	MAR	1971	USNM	?
288	F	3	165	ANT	6442	39 46 --N	71 28 --W	1016	OTT	14	NOV	1979	USNM	007130504

-----ABDOMINAL PHOTOPHORE=0 ANTERIOR EYE ORBIT PHOTOPHORE=0 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=0------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
430	?	1	2.6	DAN	3948	11 11 --S	41 57 --E	500	S200	6	JAN	1930	ZMUC	?
431	?	1	9.9	DAN	3910	5 28 --N	80 00 --E	600	S200	23	NOV	1929	ZMUC	?
432	?	1	9.9	DAN	3910	5 28 --N	80 00 --E	600	S200	23	NOV	1929	ZMUC	?
433	?	1	10.7	DAN	3910	5 28 --N	80 00 --E	600	S200	23	NOV	1929	ZMUC	?
[illegible]	?	1	8.6	THO	64	49 17 --N	14 03 --W	300	Y330	6	JUN	1906	ZMUC	?
435	?	1	5.1	THO	64	49 17 --N	14 03 --W	300	Y330	6	JUN	1906	ZMUC	?
436	?	1	15.7	THO	80	51 34 --N	11 50 --W	1200	?	16	JUN	1906	ZMUC	?
437	?	1	19.8	THO	80	51 34 --N	11 50 --W	1200	?	16	JUN	1906	ZMUC	?
438	?	1	13.0	THO	80	51 34 --N	11 50 --W	1200	?	16	JUN	1906	ZMUC	?
439	?	1	5.3	DAN	4009	24 36 30N	17 27 --W	300	S200	18	MAR	1930	ZMUC	?
440	?	1	7.2	DAN	1367	33 42 --N	36 16 --W	300	S200	10	JUN	1822	ZMUC	?
441	?	1	14.0	THO	53	48 55 --N	12 03 --W	300	Y330	21	MAY	1906	ZMUC	?
442	?	1	21.0	THO	199	39 22 --N	10 49 --[illegible]	0	?	28	AUG	1910	ZMUC	?
443	?	1	7.7	THO	62	50 25 --N	12 44 --W	300	Y330	5	JUN	1906	ZMUC	?
444	?	1	5.2	DAN	3797	2 30 30S	118 35 30E	600	S200	16	AUG	1929	ZMUC	?
445	?	1	9.0	DAN	1292	17 43 --N	64 56 --W	300	S200	16	APR	1922	ZMUC	?
446	?	1	2.7	DAN	4124	37 24 --N	2 58 --E	150	?	3	JUN	1930	ZMUC	?
447	?	1	7.7	DAN	5918	56 48 --N	20 21 --W	1800	S200	25	JUN	1938	ZMUC	?
448	?	1	4.0	DAN	3959	23 40 --S	43 02 --E	100	S150	12	JUN	1930	ZMUC	?
449	?	1	2.5	DAN	3959	23 40 --S	43 02 --E	100	S150	12	JUN	1930	ZMUC	?
450	?	1	1.8	DAN	3959	23 40 --S	43 02 --E	100	S150	12	JUN	1930	ZMUC	?
451	?	1	1.7	DAN	3860	2 57 --S	99 36 --E	250	S200	20	OCT	1929	ZMUC	?
452	?	1	1.6	DAN	3860	2 57 --S	99 36 --E	250	S200	20	OCT	1929	ZMUC	?
453	?	1	2.4	DAN	3895	5 2[illegible] --S	93 50 --E	300	S200	15	OCT	1929	ZMUC	?
454	?	1	1.4	DAN	3895	5 27 --S	93 50 --E	300	S200	15	OCT	1929	ZMUC	?

-----ABDOMINAL PHOTOPHORE=0 ANTERIOR EYE ORBIT PHOTOPHORE=0 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=1------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
100	M	1	14.0	OCE	7875	8 58 --N	21 41 --W	140	MOC	13	NOV	1978	TAMU	?
134	?	1	15.6	ILL	[illegible]	33 54 --S	-- -- ---	28	IKMT	15	AUG	1961	SAM	A29707
342	M	1	17.0	ALB	[illegible]-17N	32 31 --N	63 41 --W	320	IKMT	9	SEP	1969	USNM	00727532
426	?	1	12.5	DAN	1245	19 35 --N	73 27 --W	600	S200	17	FEB	1922	ZMUC	?

Octopoteuthis sp

--------ABDOMINAL PHOTOPHORE=0 ANTERIOR EYE ORBIT PHOTOPHORE=0 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=0--------------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT.	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
40	F	1	16.8	SPR	28	35 01 --S	152 47 --E	23	?	28	NOV	1979	MUV	F51078
41	F	1	16.3	SPR	28	35 01 --S	152 47 --E	23	?	28	NOV	1979	MUV	F51078
51	?	1	5.5	?	?	38 11 --N	15 34 --E	0	?	--	---	----	ZMUB	2950
52	?	1	18.1	?	?	38 11 --N	15 34 --E	0	?	--	---	----	ZMUB	2950
54	?	1	10.0	APP	?	38 11 --N	15 34 --E	0	?	--	---	1888	ZMUB	16586
55	?	1	3.8	MSA	53	34 59 --N	33 01 --W	200	?	9	JUN	1910	ZMUB	?
73	?	1	10.3	OCE	103-1	26 45 --N	79 44 --W	150	MOC	8	AUG	1978	TAMU	?
74	?	1	8.8	OCE	103-1	26 45 --N	79 44 --W	150	MOC	8	AUG	1978	TAMU	?
81	?	1	10.0	GYR	8108	26 14 48N	95 31 06W	210	IKMT	27	FEB	1981	TAMU	?
83	?	1	9.0	KNO	26-4	34 13 --N	71 25 --W	1200	MOC	13	APR	1977	TAMU	?
87	?	1	13.4	OCE	90-1	29 56 --N	80 00 --W	290	MOC	3	AUG	1978	TAMU	?
88	?	1	22.0	KNO	34-4	36 37 --N	66 41 --W	0	MOC	24	APR	1977	TAMU	?
89	?	1	8.0	KNO	34-4	36 77 --N	66 41 --W	0	MOC	24	APR	1977	TAMU	?
90	?	1	8.2	KNO	34-4	36 77 --N	66 41 --W	0	MOC	24	APR	1977	TAMU	?
91	?	1	9.2	KNO	34-4	36 77 --N	66 41 --W	0	MOC	24	APR	1977	TAMU	?
92	?	1	6.1	KNO	34-4	36 77 --N	66 41 --W	0	MOC	24	APR	1977	TAMU	?
93	?	1	5.2	KNO	34-4	36 77 --N	66 41 --W	0	MOC	24	APR	1977	TAMU	?
94	?	1	5.9	KNO	34-4	36 77 --N	66 41 --W	0	MOC	24	APR	1977	TAMU	?
95	?	1	5.3	KNO	34-4	36 77 --N	66 41 --W	0	MOC	24	APR	1977	TAMU	?
98	?	1	4.7	KNO	35-4	36 35 --N	66 36 --W	1000	MOC	24	APR	1977	TAMU	?
101	M	1	10.0	OCE	7880	2 30 --N	19 22 --W	400	MOC	16	NOV	1978	TAMU	?
102	?	1	19.0	KNO	29-0	36 32 --N	70 26 --W	1000	MOC	10	APR	1977	TAMU	?
103	?	1	5.6	OCE	104-0	26 42 --N	79 31 --W	350	MOD	8	AUG	1978	TAMU	?
104	?	1	8.6	OCE	136-0	30 08 --N	79 40 --W	290	MOC	14	FEB	1979	TAMU	?
105	?	1	5.8	OCE	113-3	34 22 --N	75 41 --W	1050	MOC	12	AUG	1978	TAMU	?
113	?	1	10.1	ATL	3012	28 13 --N	49 02 --W	490	IKMT	23	OCT	1973	TAMU	?
114	?	1	4.0	ALA	10-19	25 51 --N	86 13 --W	700	MET	23	JUL	1969	TAMU	4-2581
115	?	1	6.3	ALA	10-19	22 51 --N	86 13 --W	400	MET	23	JUL	1969	TAMU	4-2462
133	?	1	11.2	DSF	G2680	35 30 --S	18 52 --E	111	BONG	22	OCT	1977	SAM	S447
179	?	1	14.0	?	347	?	?	0	?	--	---	----	BMNH	19249948
249	F	1	14.0	SAN	6-17B	32 19 --N	63 37 --W	230	IKMT	29	APR	1969	USNM	00726957
252	?	1	5.0	DIS	?	31 37 30N	63 58 48W	160	RMT	20	MAR	1973	USNM	00729653
253	?	1	4.0	DIS	?	31 37 30N	63 58 48W	160	RMT	20	MAR	1973	USNM	00729653
254	?	1	4.0	DIS	?	31 37 30N	63 58 48W	160	RMT	20	MAR	1973	USNM	00729653
256	F	1	20.0	SAN	6-17B	32 19 --N	63 37 --N	235	IKMT	29	APR	1969	USNM	00726964
257	M	1	13.0	SAN	6-17B	32 19 --N	63 37 --N	235	IKMT	29	APR	1969	USNM	00726964
258	?	1	9.0	TRI	2-4-N	32 05 --N	63 52 --W	200	IKMT	7	MAR	1968	USNM	00726958
259	?	1	5.0	SAN	6-7-B	31 47 --N	63 53 --W	155	IKMT	26	APR	1969	USNM	00726965
260	?	1	10.0	SAN	9-30N	32 13 --N	63 42 --W	3500	IKMT	22	MAR	1970	USNM	00726959
261	?	1	7.0	SAN	9-30N	32 13 --N	63 42 --W	3500	IKMT	22	MAR	1970	USNM	00726959
262	?	1	8.0	DIS	8281-	32 04 24N	63 41 42W	200	RMT	15	MAR	1973	USNM	00729541
263	?	1	3.0	DIS	8281	32 04 24N	63 41 42W	200	RMT	15	MAR	1973	USNM	00729541
264	?	1	14.0	DIS	8281	31 41 54N	63 39 30W	100	RMT	16	MAR	1973	USNM	00729547
265	?	1	8.0	DIS	8281	41 59 --N	63 39 30W	100	RMT	16	MAR	1973	USNM	00729547
267	?	1	15.0	DIS	81-28	31 36 36N	63 38 42W	505	RMT	17	MAR	1973	USNM	00729566
268	M	1	17.0	SAN	10-21	31 27 --N	64 49 --W	880	IKMT	6	JUN	1970	USNM	00726967
287	?	1	6.0	DIS	81-16	32 04 24N	63 41 42W	200	RMT	15	MAR	1973	USNM	00729580
303	?	1	5.0	DIS	8281-	31 56 36N	63 48 54W	200	RMT	16	MAR	1973	USNM	00729595
304	?	1	7.0	SAN	6-7-M	31 47 --N	63 53 --W	155	IKMT	26	APR	1969	USNM	00726963
308	?	1	9.0	WES	?	30 -- --N	120 -- --W	100	TUCK	22	AUG	1972	USNM	00729910
309	?	1	10.0	SAN	13-6C	31 46 --N	64 30 --W	345	IKMT	23	FEB	1972	USNM	00728022
310	?	1	10.0	SAN	6-14A	32 20 --N	63 51 --W	55	IKMT	28	APR	1964	USNM	00726974
311	?	1	9.0	SAN	6-14A	32 20 --N	63 51 --W	55	IKMT	28	APR	1964	USNM	00726974

Octopoteuthis sp

-------ABDOMINAL PHOTOPHORE=0 ANTERIOR EYE ORBIT PHOTOPHORE=0 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=0----------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
312	?	1	11.0	SAN	6-14A	32 20 --N	63 51 --W	55	IKMT	28	APR	1964	USNM	00726974
313	?	1	7.0	SAN	9-11N	32 03 --N	64 05 --W	610	IKMT	19	MAR	1970	USNM	00726968
314	?	1	6.0	SAN	12-26	32 12 --N	64 12 --W	765	IKMT	3	SEP	1973	USNM	00728030
315	?	1	13.0	SAN	13-39	32 28 --N	64 17 --W	744	IKMT	3	MAR	1972	USNM	0072823
316	?	1	7.0	SAN	9-16N	31 45 --N	63 34 --W	290	IKMT	19	MAR	1970	USNM	00726969
317	?	1	9.0	SAN	12-36	32 22 --N	64 11 --W	222	IKMT	8	SEP	1971	USNM	00728031
318	?	1	9.0	SAN	13-21	31 41 --N	63 41 --W	602	IKMT	?			USNM	00728024
319	?	1	6.0	SAN	6-17P	32 19 --N	63 37 --W	235	IKMT	29	APR	1969	USNM	00726976
320	?	1	7.0	SAN	6-16C	32 18 --N	63 50 --W	140	IKMT	28	APR	1969	USNM	00726970
321	?	1	9.0	SAN	10-8A	32 03 --N	64 25 --W	90	IKMT	3	JUN	1970	USNM	00726960
322	?	1	10.0	SAN	6-12A	32 05 --N	63 42 --W	50	IKMT	27	APR	1969	USNM	00726961
323	?	1	8.0	SAN	13-10	32 20 --N	63 33 --W	96	IKMT	25	FEB	1972	USNM	00728025
324	?	1	10.0	SAN	6-14B	32 20 --N	63 51 --W	58	IKMT	28	APR	1969	USNM	00726977
325	?	1	10.0	SAN	6-14B	32 20 --N	63 51 --W	96	IKMT	28	APR	1969	USNM	00226977
326	?	1	8.0	SAN	6-14B	32 20 --N	63 51 --W	58	IKMT	38	APR	1969	USNM	00726977
327	?	1	9.0	SAN	6-26N	32 18 --N	63 55 --W	200	IKMT	30	APR	1969	USNM	00726971
328	?	1	8.0	SAN	14-9P	31 46 --N	63 38 --W	150	IKMT	7	JUN	1972	USNM	00728033
329	?	1	8.0	SAN	13-14	31 51 --N	63 47 --W	208	IKMT	26	FEB	1972	USNM	00728026
330	?	1	10.0	SAN	9-32N	32 17 --N	63 36 --W	90	IKMT	23	MAR	1970	USNM	00726978
331	?	1	10.0	SAN	9-26N	31 53 --N	63 55 --W	0	IKMT	22	MAY	1970	USNM	00726972
332	?	1	8.0	SAN	9-26N	31 53 --N	63 55 --W	0	IKMT	22	MAR	1970	USNM	00726972
333	?	1	7.0	DIS	81-20	31 47 42N	63 37 18W	25	RMT	16	MAR	1973	USNM	00729496
335	?	1	8.0	SAN	6-13P	32 13 --N	60 44 --W	175	IKMT	28	APR	1969	USNM	00726979
336	?	1	6.0	SAN	6-13P	32 13 --N	63 44 --W	175	IKMT	28	APR	1969	USNM	00726979
337	?	1	3.0	SAN	6-13P	32 13 --N	63 44 --W	175	IKMT	28	APR	1969	USNM	00726979
338	?	1	9.5	SAN	9-13N	32 04 --N	63 45 --W	1500	IKMT	23	MAR	1970	USNM	00726973
347	?	1	27.0	SAN	6-11P	31 57 --W	63 37 --W	800	IKMT	27	APR	1969	USNM	00728034
367	M	1	19.0	WES	?	30 -- --N	120 -- --W	250	?	22	AUG	1972	USNM	00729911
370	?	1	9.0	BEL	37-3	41 44 --N	57 38 --W	200	EMT	5	APR	1979	IMFD	?
395	?	1	9.0	THO	74	49 23 --N	12 13 --W	200	Y330	10	JUN	1906	ZMUC	?
396	?	1	6.0	THO	74	49 23 --N	12 13 --W	200	Y330	10	JUN	1906	ZMUC	?
404	?	1	6.6	DAN	3962	24 33 --S	38 26 --E	100	S200	14	JAN	1930	ZMUC	?
406	?	1	15.0	THO	80	51 34 --N	11 50 --W	1200	?	16	JUN	1906	ZMUC	?
407	?	1	14.5	THO	80	51 34 --N	11 50 --W	1200	?	16	JUN	1906	ZMUC	?
408	?	1	20.8	THO	80	51 34 --N	11 50 --W	1200	?	16	JUN	1906	ZMUC	?
409	?	1	11.1	DAN	4202	47 36 --N	28 39 --W	100	S200	29	NOV	1931	ZMUC	?
410	?	1	4.0	DAN	4119	40 13 --N	12 06 --E	600	?	30	MAY	1930	ZMUC	?
411	?	1	11.4	DAN	3687	7 14 --N	115 23 --W	300	S200	8	APR	1929	ZMUC	?
413	?	1	5.8	DAN	3915	14 16 --S	41 48 --E	300	S200	7	JAN	1930	ZMUC	?
414	?	1	6.2	DAN	4119	40 13 --N	12 06 --E	1200	?	30	MAY	1930	ZMUC	?
415	?	1	6.3	DAN	3964	25 19 --S	36 13 --E	600	?	15	JAN	1930	ZMUC	?
416	?	1	2.7	DAN	5920	1 12 --S	62 19 --E	100	S200	9	DEC	1929	ZMUC	?
417	?	1	9.5	DAN	3924	5 01 --S	54 46 --E	1000	E300	14	DEC	1929	ZMUC	?
418	?	1	2.6	PAC	4799	19 02 --N	119 38 --E	201	S150	12	MAR	1934	ZMUC	?
419	?	1	13.8	DAN	3917	1 45 --N	71 05 --E	300	S200	5	DEC	1929	ZMUC	?
420	?	1	10.8	DAN	3939	11 35 --S	49 45 --E	300	S200	20	DEC	1929	ZMUC	?
422	?	1	1.9	DAN	866	28 32 --N	56 38 --W	50	S200	2	SEP	1920	ZMUC	?
423	?	1	1.4	DAN	3887	00 36 --N	96 25 30E	350	?	4	NOV	1929	ZMUC	?
424	?	1	0.0	DAN	3797	2 30 30S	118 35 30E	300	S200	16	AUG	1929	ZMUC	?
425	?	1	7.3	DAN	3908	4 28 --N	82 13 --E	600	S200	22	NOV	1929	ZMUC	?
427	?	1	2.2	DAN	4124	37 24 --N	2 58 --E	250	?	3	JUN	1930	ZMUC	?
428	?	1	7.2	DAN	3948	11 11 --S	41 57 --E	500	S200	6	JAN	1930	ZMUC	?
429	?	1	6.1	DAN	3948	11 11 --S	41 57 --E	500	S200	8	JAN	1930	ZMUC	?

Octopoteuthis sp

-----ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE-ORBIT PHOTOPHORE=0 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=0-----------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
72	?	1	15.5	OCE	113-3	34 22 --N	75 41 --W	1050	MOC	12	AUG	1978	TAMU	?
77	?	1	19.0	KNO	9	39 42 --N	67 23 --W	790	IKMT	29	AUG	1975	TAMU	?
113	?	1	17.0	ATL	2930	11 00 --N	41 31 --W	475	IKMT	18	SEP	1973	TAMU	?
412	?	1	9.2	DAN	3956	21 13 --S	42 26 --E	500	S200	10	JAN	1930	ZMUC	?

-----ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE ORBIT PHOTOPHORE=0 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=1-----------

SPECNO	SEX	MATUR	MANLEN	COLL	STAT	LAT	LONG	DEPTH	GEAR	DAY	MON	YEAR	MUS	CATNO
344	F	1	16	DIS	81-10	31 51 36N	63 49 18W	800	RMT	14	MAR	1973	USNM	-00729506
346	M	1	26	DIS	81-53	32 12 24N	64 17 18W	205	RMT	26	MAR	1973	USNM	-00730038

APPENDIX 2

The following appendix includes the specimen morphometric and meristic data for each species listed. In the case of the measurements all 0.0 are missing data (except those in larval ie. < 25 mm ML specimens). The abdominal photophore (abdphot) column the numbers used equal the number of photophores present 2 or 1 (or 0 in larvae). In the other meristics (anteye, eyebal, and hook) 9 = missing data, 0 = absent, and 1 = present. See materials amd methods chapter for definition of abbreviations.

Octopoteuthis sicula

------ABDOMINAL PHOTOPHORE=2   ANTERIOR EYE ORBIT PHOTOPHORE=0   EYEBALL PHOTOPHORE=0   ACCESSORY HOOK CUSPS=1-----------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
6	17.0	42.0	59.0	20.0	17.7	6.0	12.0	4.5	0	0	0.0
9	30.0	76.0	100.0	31.0	24.0	17.0	21.7	7.6	0	0	0.0
10	39.4	72.0	100.0	36.0	36.0	17.0	27.5	8.9	0	0	0.0
11	0.0	97.0	120.0	34.2	32.6	17.0	22.5	8.5	0	0	0.0
12	0.0	71.0	109.0	33.0	0.0	16.0	23.0	7.5	0	0	0.0
13	22.0	70.0	96.0	30.0	22.0	18.0	22.8	7.2	0	0	0.0
14	32.0	88.0	121.0	31.9	36.0	28.0	25.2	8.9	0	0	233.9
15	34.0	95.0	122.0	40.0	38.8	0.0	26.5	9.0	0	0	0.0
16	30.0	95.0	120.0	35.7	30.0	21.0	24.5	8.5	0	0	0.0
17	33.0	90.0	108.0	32.0	35.0	19.0	24.0	8.5	0	0	0.0
22	12.2	23.0	52.0	21.0	13.0	7.0	8.5	3.9	0	0	0.0
23	33.4	94.0	112.0	38.3	28.7	10.0	23.5	7.7	0	0	0.0
24	24.0	57.0	86.0	28.0	27.6	18.0	20.5	6.9	0	0	160.0
28	20.0	50.0	81.0	24.8	23.5	10.0	18.5	6.6	0	0	0.0
29	20.0	59.0	84.0	27.2	20.6	10.0	16.6	5.4	0	0	0.0
32	26.2	93.0	134.0	33.0	26.7	10.0	23.0	0.0	0	0	0.0
33	7.3	16.0	33.0	10.5	8.7	3.5	4.0	1.3	0	0	0.0
36	9.5	20.0	28.9	6.8	9.0	2.0	5.9	1.5	0	0	51.0
37	17.0	45.5	70.0	26.6	19.6	8.0	13.1	4.5	0	0	0.0
47	22.0	54.0	77.0	31.8	27.2	14.0	19.5	7.2	0	0	0.0
76	11.0	26.6	43.6	10.6	9.7	3.0	6.3	2.1	0	0	0.0
78	18.0	50.0	67.0	23.5	19.8	11.1	16.6	5.8	0	0	151.5
80	7.4	19.0	36.0	9.7	8.0	3.3	3.6	1.0	0	0	0.0
106	10.0	26.0	41.0	13.6	11.7	4.0	6.5	2.3	0	0	0.0
107	9.1	22.0	33.0	11.0	11.5	3.5	6.5	1.9	0	0	0.0
109	8.1	18.0	29.0	8.2	9.2	3.0	4.7	1.4	0	0	54.2
122	61.0	180.0	208.0	69.0	57.8	52.0	33.5	13.5	0	0	0.0
145	14.0	28.0	48.0	17.0	15.2	5.0	10.5	3.3	0	0	89.0
146	11.5	22.0	40.0	11.6	12.5	4.0	5.0	1.5	0	0	0.0
147	11.0	28.0	41.0	15.7	10.0	4.0	8.7	3.0	0	0	0.0
148	12.5	29.0	44.0	16.5	14.0	6.0	8.7	3.0	0	0	0.0
149	13.0	28.0	43.0	15.5	14.8	5.0	8.8	3.4	0	0	0.0
150	10.0	28.0	46.0	15.3	12.5	5.0	8.7	3.0	0	0	0.0
157	11.0	27.0	42.0	19.0	13.7	5.0	9.0	3.7	0	0	0.0
155	10.5	24.0	43.0	15.1	11.1	5.0	8.6	3.0	0	0	0.0
157	13.0	31.0	49.0	21.0	15.8	5.0	11.7	4.0	0	0	0.0
158	12.6	24.0	42.0	16.0	12.2	5.0	9.2	0.0	0	0	0.0
159	11.0	26.0	45.0	17.1	12.2	5.0	9.0	3.2	0	0	0.0
160	10.6	25.0	41.0	16.6	11.0	5.0	8.8	3.0	0	0	0.0
161	12.0	24.0	38.0	17.0	13.0	5.0	8.3	3.6	0	0	0.0
162	15.3	37.0	56.0	21.3	19.0	5.0	12.2	4.6	0	0	0.0
163	17.0	31.0	47.0	18.1	19.2	6.0	10.0	3.9	0	0	0.0
164	13.5	26.0	40.0	16.0	14.0	3.0	11.5	3.5	0	0	0.0
165	10.0	26.0	45.0	17.7	10.7	5.0	9.6	3.9	0	0	0.0
166	13.4	24.0	42.0	17.7	15.4	5.0	8.2	3.0	0	0	0.0
167	13.0	24.0	43.0	13.6	13.5	5.0	8.0	3.5	0	0	0.0
241	0.0	122.0	156.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0
284	0.0	34.0	51.0	0.0	0.0	6.0	0.0	0.0	0	0	0.0
340	0.0	140.0	183.0	0.0	0.0	30.0	0.0	0.0	0	0	0.0

Octopoteuthis sicula

--------ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE ORBIT PHOTOPHORE=0 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=1--------------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
341	0.0	138.0	175.0	0.0	0.0	26.0	0.0	0.0	0	0	0.0
345	0.0	27.0	48.0	0.0	0.0	6.0	0.0	0.0	0	0	0.0
348	0.0	23.0	36.0	0.0	0.0	3.0	0.0	0.0	0	0	0.0
351	0.0	28.0	40.0	0.0	0.0	3.0	0.0	0.0	0	0	0.0
352	0.0	25.0	45.0	0.0	0.0	5.0	0.0	0.0	0	0	0.0
354	0.0	54.0	82.0	0.0	0.0	20.0	0.0	0.0	0	0	0.0
361	0.0	85.0	112.0	0.0	0.0	20.0	0.0	0.0	0	0	0.0
362	0.0	88.0	115.0	0.0	0.0	15.0	0.0	0.0	0	0	0.0
363	0.0	37.0	56.0	0.0	0.0	8.0	0.0	0.0	0	0	0.0
364	0.0	80.0	118.0	0.0	0.0	20.0	0.0	0.0	0	0	0.0
365	0.0	90.0	128.0	0.0	0.0	22.0	0.0	0.0	0	0	0.0
366	0.0	43.0	59.0	0.0	0.0	11.0	0.0	0.0	0	0	0.0
372	0.0	51.0	70.0	0.0	0.0	20.0	0.0	0.0	0	0	0.0
373	0.0	150.0	169.0	0.0	0.0	40.0	0.0	0.0	0	0	0.0
375	0.0	92.0	127.0	0.0	0.0	20.0	0.0	0.0	0	0	0.0
376	0.0	86.0	112.0	0.0	0.0	23.0	0.0	0.0	0	0	0.0
377	0.0	80.0	106.0	0.0	0.0	15.0	0.0	0.0	0	0	0.0
388	23.2	58.0	90.0	27.5	24.8	12.0	19.8	6.5	0	0	0.0
389	43.8	97.0	131.0	38.2	37.5	27.0	27.5	9.0	0	0	0.0
456	13.0	21.7	35.0	22.9	22.0	2.9	6.5	2.1	0	0	53.6

Octopoteuthis sicula ??

--------ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE ORBIT PHOTOPHORE=0 EYEBALL PHOTOPHORE=9 ACCESSORY HOOK CUSPS=1--------------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
42	65	170	230	73.5	60	46	35.5	0	0	0	0
244	0	130	145	? 0.0	0	21	0.0	0	0	0	0

Octopoteuthis megaptera

--------ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=1 ACCESSORY HOOK CUSPS=1--------------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
5	20.0	38.0	51.0	23.0	21.0	16.0	13.5	5.0	0	0	157.0
7	16.0	40.0	67.0	22.0	16.5	11.0	13.5	4.5	0	0	0.0
8	33.5	71.0	105.0	32.5	35.0	20.0	20.2	6.0	0	0	0.0
25	11.3	26.0	45.0	15.2	11.7	6.0	7.7	3.1	0	0	0.0
38	16.0	35.0	54.0	23.5	16.0	6.0	14.0	4.2	0	0	0.0
39	12.2	31.0	52.0	19.7	12.1	7.0	8.1	0.0	0	0	0.0
43	13.0	28.0	43.0	11.7	14.4	6.0	8.8	3.0	0	0	0.0
44	12.5	30.0	45.0	16.0	14.0	6.0	8.5	2.1	0	0	0.0

Octopoteuthis megaptera

---------ABDOMINAL PHOTOPHORE=2   ANTERIOR EYE ORBIT PHOTOPHORE=1   EYEBALL PHOTOPHORE=1   ACCESSORY HOOK CUSPS=1---------------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
45	14.0	32.0	44.0	12.0	15.0	7.0	9.5	3.5	0	0	0.0
46	25.2	57.0	75.0	25.9	24.2	17.0	18.8	6.0	0	0	0.0
48	15.5	44.0	66.0	18.8	16.2	7.0	12.2	4.0	0	0	0.0
49	10.5	28.3	47.8	15.6	12.6	7.5	9.7	1.0	0	0	0.0
50	13.0	35.0	55.0	19.8	13.2	10.0	10.4	2.7	0	0	0.0
56	20.5	49.0	67.0	23.0	20.2	13.0	14.2	5.2	0	0	0.0
58	43.0	115.0	145.0	58.7	38.0	45.0	29.0	10.0	0	0	0.0
59	33.2	102.0	128.0	40.8	35.6	40.0	27.5	10.7	0	0	0.0
60	29.2	80.0	107.0	42.7	32.7	24.0	25.3	8.4	0	0	261.7
63	25.6	73.0	92.0	34.2	23.3	15.0	21.6	9.0	0	0	0.0
65	24.0	60.0	79.0	30.7	25.5	23.0	21.2	7.0	0	0	0.0
66	12.0	29.0	45.0	17.8	15.0	10.0	12.2	3.8	0	0	0.0
67	28.0	97.0	121.0	41.8	27.0	34.0	24.0	7.0	0	0	0.0
68	39.0	92.0	121.0	47.4	35.5	36.0	27.7	10.5	0	0	312.4
70	22.0	65.0	82.0	30.8	22.5	17.0	22.8	7.8	0	0	0.0
84	10.7	27.0	37.0	27.0	12.0	6.0	9.2	2.6	0	0	0.0
85	20.5	61.0	80.0	33.5	18.6	14.0	18.3	5.6	0	0	183.0
108	11.0	27.0	41.0	16.2	12.8	4.0	8.0	2.4	0	0	108.2
110	22.2	53.0	70.0	32.6	23.6	4.0	21.0	7.0	0	0	0.0
111	10.0	26.0	41.0	16.1	12.7	6.0	8.5	2.8	0	0	81.1
116	11.7	25.0	48.0	13.3	14.2	5.0	9.2	2.5	0	0	0.0
126	13.5	29.0	43	16.2	14.8	9.0	10.5	3.0	0	0	92.2
127	17.8	33.8	56	0.0	18.9	12.7	13.3	5.3	0	0	0.0
128	17.0	32.0	52	17.0	10.0	13.0	4.2	2.0	0	0	0.0
129	17.4	31.0	48	21.4	12.5	10.0	13.2	4.7	0	0	104.4
130	12.0	25.0	36	12.5	11.4	4.0	6.0	2.5	0	0	67.5
131	11.0	25.0	38	11.7	11.1	4.0	6.0	2.4	0	0	73.4
132	17.0	32.0	51	23.7	17.0	8.0	12.8	4.8	0	0	111.7
168	25.5	48.0	72	32.2	26.6	15.0	17.7	6.4	0	0	0.0
169	25.5	60.0	84	34.0	27.0	16.0	21.0	7.2	0	0	0.0
170	15.3	50.0	70	24.3	20.7	15.0	17.2	5.4	0	0	0.0
174	44.0	127.0	160	45.5	36.5	23.0	26.0	9.5	0	0	322.5
178	44.0	125.0	144	35.0	34.0	22.0	25.0	6.5	0	0	305.0
191	0.0	96.0	0	0.0	0.0	32.0	0.0	0.0	0	0	0.0
193	0.0	110.0	127	0.0	0.0	37.0	0.0	0.0	0	0	0.0
197	0.0	63.0	84	0.0	0.0	15.0	0.0	0.0	0	0	0.0
210	10.5	26.0	40	13.5	10.0	4.0	5.0	1.5	0	0	85.5
211	10.0	23.0	35	10.0	10.0	3.0	5.0	1.5	0	0	62.0
212	28.5	70.0	94	38.0	28.5	24.0	22.0	6.0	0	0	0.0
219	24.0	68.0	85	30.5	20.7	21.0	17.5	5.5	0	0	0.0
221	25.7	59.0	80	35.0	29.3	20.0	22.5	7.3	0	0	0.0
222	0.0	64.0	86	0.0	0.0	18.0	0.0	0.0	0	0	0.0
223	0.0	75.0	92	0.0	0.0	26.0	22.7	7.7	0	0	0.0
224	71.0	71.0	103	0.0	0.0	21.0	0.0	0.0	0	0	0.0
225	24.0	74.0	100	36.0	25.0	24.0	22.8	7.5	0	0	0.0
228	25.7	52.0	77	32.0	28.8	18.0	22.0	7.0	0	0	0.0
229	12.2	25.0	41	17.0	13.5	5.0	7.7	0.0	0	0	0.0
230	36.6	92.0	0	43.3	31.0	20.0	24.0	7.7	0	0	343.3
234	11.5	27.0	42	15.7	12.7	8.0	9.1	2.5	0	0	0.0

Octopoteuthis megaptera

-------ABDOMINAL PHOTOPHORE=2   ANTERIOR EYE ORBIT PHOTOPHORE=1   EYEBALL PHOTOPHORE=1   ACCESSORY HOOK CUSPS=1----------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
235	10.8	28.0	41	17.8	13.0	6.0	9.5	2.7	0	0	81.8
236	25.0	61.0	80	32.5	29.9	15.0	22.1	7.2	0	0	0.0
237	20.4	40.0	57	25.8	20.8	15.0	17.5	5.5	0	0	0.0
238	23.0	51.0	70	28.0	25.3	15.0	18.3	6.0	0	0	0.0
239	13.0	33.0	52	21.0	15.3	5.0	11.6	3.8	0	0	0.0
240	12.5	29.0	49	20.0	15.5	5.0	9.5	3.0	0	0	0.0
246	25.5	84.0	105	42.0	28.3	20.0	23.0	7.7	0	0	242.0
369	0.0	100.0	122	0.0	0.0	36.0	0.0	0.0	0	0	0.0
397	22.3	78.0	92	30.1	24.0	25.0	25.2	7.1	0	0	0.0
398	21.5	64.0	0	32.0	23.0	26.0	19.5	5.0	0	0	198.0
399	12.0	35.0	52	15.9	13.5	10.0	10.3	2.8	0	0	0.0
401	0.0	32.0	50	0.0	0.0	10.0	0.0	0.0	0	0	0.0

Octopoteuthis megaptera ??

-------ABDOMINAL PHOTOPHORE=2   ANTERIOR EYE ORBIT PHOTOPHORE=1   EYEBALL PHOTOPHORE=9   ACCESSORY HOOK CUSPS=1----------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
137	33.0	92	125	48.7	33.0	18	21.0	7.2	0	0	0
138	0.0	90	122	48.5	31.0	15	21.0	7.0	0	0	0
247	41.4	115	146	52.2	38.9	33	9.5	9.5	0	0	0
270	0.0	72	95	0.0	0.0	26	0.0	0.0	0	0	0
273	0.0	61	88	0.0	0.0	30	0.0	0.0	0	0	0
274	0.0	103	141	0.0	0.0	17	0.0	0.0	0	0	0
275	0.0	83	109	0.0	0.0	32	0.0	0.0	0	0	0
281	0.0	28	50	0.0	0.0	7	0.0	0.0	0	0	0
285	0	30	42	0	0	7	0	0	0	0	0
286	0	35	37	0	0	8	0	0	0	0	0
289	0	50	68	0	0	15	0	0	0	0	0
301	0	37	56	0	0	0	0	0	0	0	0
349	0	29	46	0	0	8	0	0	0	0	0
350	0	32	48	0	0	9	0	0	0	0	0
355	0	94	127	0	0	25	0	0	0	0	0
368	0	29	45	0	0	7	0	0	0	0	0

-------ABDOMINAL PHOTOPHORE=2   ANTERIOR EYE ORBIT PHOTOPHORE=1   EYEBALL PHOTOPHORE=1   ACCESSORY HOOK CUSPS=0----------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
1	20	47	65	21	20	9	15.7	5.6	0	0	0

-------ABDOMINAL PHOTOPHORE=0   ANTERIOR EYE ORBIT PHOTOPHORE=1   EYEBALL PHOTOPHORE=1   ACCESSORY HOOK CUSPS=1----------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
71	0	0	0	47.5	24.8	0	23.8	0.0	0	0	0
231	0	0	0	47.5	36.0	0	28.9	9.5	0	0	0

Octopoteuthis danae

--------ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE ORBIT PHOTOPHORE=0 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=0--------------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
2	25.7	47	68	20.7	32.5	13.0	19.5	6.6	0	0	0.0
4	18.0	36	55	18.0	20.0	9.0	12.5	4.5	0	0	0.0
18	20.0	57	80	26.0	22.2	11.0	17.0	6.2	0	0	0.0
19	19.0	45	69	21.0	19.5	6.0	16.0	5.5	0	0	0.0
30	22.0	50	72	24.5	25.0	5.0	13.0	5.0	0	0	0.0
31	16.2	35	58	19.2	17.5	11.0	12.1	4.6	0	0	0.0
79	15.0	50	80	25.5	19.0	10.0	15.0	5.5	0	0	0.0
99	22.2	49	70	21.9	21.8	8.0	16.5	5.5	0	0	0.0
117	11.2	22	43	16.2	14.2	7.0	10.4	3.9	0	0	0.0
152	13.2	28	45	18.0	14.0	6.0	8.7	3.4	0	0	0.0
217	0.0	22	35	0.0	0.0	0.0	0.0	0.0	0	0	0.0
343	0.0	26	45	0.0	0.0	4.0	0.0	0.0	0	0	0.0
353	0.0	70	70	0.0	0.0	15.0	0.0	0.0	0	0	0.0
356	0.0	98	131	0.0	0.0	0.0	0.0	0.0	0	0	0.0
358	0.0	43	64	0.0	0.0	0.0	0.0	[illegible]	0	0	0.0
359	0.0	38	60	0.0	0.0	0.0	0.0	0.0	0	0	0.0
360	0.0	42	64	0.0	0.0	0.0	0.0	0.0	0	0	0.0
371	0.0	40	58	0.0	0.0	10.0	0.0	0.0	0	0	0.0
378	17.5	41	62	21.0	17.2	9.0	13.8	4.8	0	0	0.0
379	23.5	56	83	27.3	26.8	17.0	17.7	6.8	0	0	0.0
380	22.2	44	69	21.9	21.0	13.0	16.0	5.8	0	0	0.0
381	20.8	52	74	22.0	20.0	10.0	15.3	5.4	0	0	0.0
382	0.0	71	77	23.5	0.0	13.0	15.7	5.7	0	0	0.0
383	0.0	47	71	21.9	0.0	0.0	0.0	0.0	0	0	0.0
384	22.4	47	68	21.0	21.9	11.0	14.7	5.0	0	0	0.0
385	20.5	45	65	20.5	0.0	10.0	13.0	4.8	0	0	0.0
387	24.8	54	82	23.0	29.2	9.0	18.3	6.6	0	0	0.0
390	26.0	75	97	31.2	24.6	18.0	21.7	8.0	0	0	0.0
392	11.5	25	44	14.0	13.4	7.0	8.0	0.0	0	0	0.0
393	12.3	27	52	16.0	14.2	2.5	10.2	3.0	0	0	0.0
400	13.3	28	47	14.9	14.2	1.0	8.0	3.0	0	0	82.9
403	10.0	23	35	12.8	11.5	6.0	8.1	3.0	0	0	64.8

Octopoteuthis deletron

------ABDOMINAL PHOTOPHORE=1 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=1--------------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
34	25.0	78	98	32.5	27.5	8	21.0	6.7	0	0	0
35	28.0	75	112	31.0	29.0	18	23.5	8.0	0	0	0
118	30.0	80	96	23.0	29.3	8	22.3	8.3	0	0	205
135	51.0	132	161	41.0	51.0	31	29.0	10.6	0	0	0
141	14.0	35	53	19.8	15.0	6	12.7	4.2	0	0	0
142	14.0	32	53	17.6	12.2	4	9.0	3.0	0	0	0
143	20.0	45	67	19.0	14.6	6	0.0	0.0	0	0	0

Octopoteuthis deletron

-------ABDOMINAL PHOTOPHORE=1 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=1-------------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
144	12.0	31	49	11.0	13.5	4	10.0	3.5	0	0	0
172	26.0	65	83	31.2	26.7	5	15.9	6.7	0	0	0
173	21.5	50	70	21.5	24.8	4	15.9	5.5	0	0	0
183	0.0	37	54	0.0	0.0	7	0.0	0.0	0	0	0
184	0.0	37	57	0.0	0.0	9	0.0	0.0	0	0	0
185	0.0	36	64	0.0	0.0	6	0.0	0.0	0	0	0
186	0.0	47	69	0.0	0.0	0	0.0	0.0	0	0	0
187	0.0	37	56	0.0	0.0	3	0.0	0.0	0	0	0
188	0.0	105	120	0.0	0.0	33	0.0	0.0	0	0	0
192	0.0	130	151	0.0	0.0	27	0.0	0.0	0	0	0
194	0.0	100	116	0.0	0.0	22	0.0	0.0	0	0	0
195	0.0	37	58	0.0	0.0	0	0.0	0.0	0	0	0
196	0.0	117	128	0.0	0.0	23	0.0	0.0	0	0	0
199	0.0	24	35	0.0	0.0	0	0.0	0.0	0	0	0
201	0.0	29	48	0.0	0.0	6	0.0	0.0	0	0	0
202	0.0	32	48	0.0	0.0	5	0.0	0.0	0	0	0
203	0.0	30	46	0.0	0.0	5	0.0	0.0	0	0	0
204	0.0	30	41	0.0	0.0	2	0.0	0.0	0	0	0
205	0.0	25	38	0.0	0.0	2	0.0	0.0	0	0	0
206	0.0	33	48	0.0	0.0	2	0.0	0.0	0	0	0
207	0.0	23	33	0.0	0.0	0	0.0	0.0	0	0	0
300	0.0	28	42	0.0	0.0	0	0.0	0.0	0	0	0

Octopoteuthis deletron ??

------ABDOMINAL PHOTOPHORE=1 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=9 ACCESSORY HOOK CUSPS=1-------------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
139	38	117	150	58.5	39	28	26.6	8	0	0	359.5

--------ABDOMINAL PHOTOPHORE=1 ANTERIOR EYE ORBIT PHOTOPHORE=9 EYEBALL PHOTOPHORE=9 ACCESSORY HOOK CUSPS=1-------------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
190	0	87	88	0	0	0	0	0	0	0	0

Octopoteuthis sp A

-------ABDOMINAL PHOTOPHORE=1 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=0--------------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
57	8.5	27	39	16.0	9.8	6	7.3	2.3	0	0	0.0
62	32.3	80	100	43.4	39.6	25	27.4	10.9	0	0	230.4
64	20.0	55	86	27.0	21.5	7	14.0	4.5	0	0	0.0
69	28.3	80	99	40.8	30.0	24	27.8	10.0	0	0	0.0
243	17.2	47	70	28.5	16.5	14	15.5	5.0	0	0	0.0
250	39.8	113	125	51.8	31.0	25	28.0	7.8	0	0	0.0
251	0.0	130	150	56.7	0.0	20	0.0	0.0	0	0	0.0
255	0.0	65	89	0.0	0.0	15	0.0	0.0	0	0	0.0
266	0.0	52	68	0.0	0.0	10	0.0	0.0	0	0	0.0
277	0.0	58	74	0.0	0.0	14	0.0	0.0	0	0	0.0
290	0.0	80	106	0.0	0.0	17	0.0	0.0	0	0	0.0
291	0.0	113	141	0.0	0.0	21	0.0	0.0	0	0	0.0
307	0.0	80	102	0.0	0.0	7	0.0	0.0	0	0	0.0

Octopoteuthis sp A ??

-------ABDOMINAL PHOTOPHORE=1 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=9 ACCESSORY HOOK CUSRS=0--------------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
294	0	127	161	0	0	24	0	0	0	0	0
295	0	130	158	0	0	25	0	0	0	0	0
296	0	73	101	0	0	20	0	0	0	0	0

Octopoteuthis sp

-------ABDOMINAL PHOTOPHORE=0 ANTERIOR EYE ORBIT PHOTOPHORE=0 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=0--------------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
53	0.0	29.5	45.0	0.0	0.0	0.0	8.1	3.0	0	0	0.0
82	9.5	20.2	35.0	9.0	10.0	0.0	6.8	1.9	0	0	49.0
86	0.0	25.4	45.4	0.0	10.3	8.9	0.0	0.0	0	0	0.0
96	8.0	16.3	21.7	6.3	8.5	0.0	3.8	1.3	0	0	44.2
154	0.0	22.0	37.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0
208	0.0	21.0	36.0	0.0	0.0	1.0	0.0	0.0	0	0	0.0
209	0.0	22.0	38.0	0.0	0.0	2.0	0.0	0.0	0	0	0.0
269	0.0	23.0	35.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0
357	0.0	54.0	72.0	0.0	0.0	12.0	0.0	0.0	0	0	0.0
391	0.0	0.0	0.0	36.7	38.4	0.0	31.0	10.0	0	0	0.0
394	13.0	29.0	40.0	11.7	12.2	0.0	7.8	2.8	0	0	0.0

Octopoteuthis sp

--------ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE ORBIT PHOTOPHORE=9 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=1------------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
242	0	38	60	21	0	13	13.8	4.8	0	0	115

--------ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE ORBIT PHOTOPHORE=9 EYEBALL PHOTOPHORE=9 ACCESSORY HOOK CUSPS=0------------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
27	14	35	57	19.5	0.0	7	0.0	0.0	0	0	0.0
136	49	103	146	53.4	55.2	27	32.7	14.5	0	0	280.4
153	19	51	74	25.7	21.0	7	14.0	4.8	0	0	0.0
176	0	80	105	0.0	0.0	18	0.0	0.0	0	0	0.0
180	0	31	45	0.0	0.0	0	0.0	0.0	0	0	0.0
215	0	58	85	0.0	0.0	8	0.0	0.0	0	0	0.0
216	0	40	68	0.0	0.0	0	0.0	0.0	0	0	0.0
278	0	54	84	0.0	0.0	16	0.0	0.0	0	0	0.0

--------ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE ORBIT PHOTOPHORE=9 EYEBALL PHOTOPHORE=9 ACCESSORY HOOK CUSPS=1------------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
21	28	60.0	86	0.0	0.0	14.0	0	0.0	0	0	0.0
123	60	165.0	190	77.2	54.5	40.0	31	9.5	0	0	483.2
125	0	84.5	119	39.2	43.0	15.6	27	0.0	0	0	0.0
276	0	51.0	72	0.0	0.0	7.0	0	0.0	0	0	0.0
297	0	123.0	163	0.0	0.0	25.0	0	0.0	0	0	0.0

------ABDOMINAL PHOTOPHORE=1 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=1 ACCESSORY HOOK CUSPS=1------------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
292	0	26	46	0	0	3	0	0	0	0	0

--------ABDOMINAL PHOTOPHORE=2 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=0------------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
3	20.5	55	77	27.5	22.0	14	15.3	5.4	0	0	160.5
189	0.0	62	90	0.0	0.0	17	0.0	0.0	0	0	0.0
283	0.0	27	45	0.0	0.0	9	0.0	0.0	0	0	0.0
402	11.0	24	41	12.8	11.7	2	7.3	2.5	0	0	71.8

Octopoteuthis sp

--ABDOMINAL PHOTOPHORE=0 ANTERIOR EYE ORBIT PHOTOPHORE=0 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=1--

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
75	11	23.0	35.6	11.1	10.1	4	4.5	1.7	0	0	64.9
97	6	14.5	25.1	8.5	7.1	2	4.6	1.2	0	0	41.5
181	0	23.0	41.0	0.0	0.0	0	0.0	0.0	0	0	0.0
182	0	21.0	33.0	0.0	0.0	0	0.0	0.0	0	0	0.0
279	0	25.0	34.0	0.0	0.0	0	0.0	0.0	0	0	0.0
374	0	90.0	120.0	0.0	0.0	19	0.0	0.0	0	0	0.0
386	27	73.0	94.0	32.0	29.0	10	20.6	7.5	0	0	0.0

--ABDOMINAL PHOTOPHORE=0 ANTERIOR EYE ORBIT PHOTOPHORE=0 EYEBALL PHOTOPHORE=1 ACCESSORY HOOK CUSPS=0--

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
156	14	24	40	15.3	16.7	8.4	3.5	2	0	0	0

--ABDOMINAL PHOTOPHORE=0 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=0--

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
299	0	125	155	0	0	0	0	0	0	0	0

--ABDOMINAL PHOTOPHORE=0 ANTERIOR EYE ORBIT PHOTOPHORE=1 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=1--

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
305	0	36	56	0	0	10	0	0	0	0	0
306	0	32	57	0	0	7	0	0	0	0	0

--ABDOMINAL PHOTOPHORE=0 ANTERIOR EYE ORBIT PHOTOPHORE=9 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=1--

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
293	0	140	182	0	0	26	0	0	0	0	0

--ABDOMINAL PHOTOPHORE=0 ANTERIOR EYE ORBIT PHOTOPHORE=9 EYEBALL PHOTOPHORE=9 ACCESSORY HOOK CUSPS=0--

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
26	15	43	67	23	15	12	16	4.6	0	0	0
218	0	92	135	0	0	22	0	0.0	0	0	0

Octopoteuthis sp

------ABDOMINAL PHOTOPHORE=0 ANTERIOR EYE ORBIT PHOTOPHORE=9 EYEBALL PHOTOPHORE=9 ACCESSORY HOOK CUSPS=1------------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	LENSDIAM	RTTENT	LFTENT	TOTLEN
20	35	137	184	52.2	37.8	30	26.5	0	0	0	0
226	0	115	143	0.0	0.0	18	0.0	0	0	0	0
227	0	46	58	0.0	0.0	0	0.0	0	0	0	0
232	0	62	85	0.0	0.0	7	0.0	0	0	0	0
233	31	31	50	0.0	0.0	3	0.0	0	0	0	0
248	0	138	172	0.0	0.0	34	0.0	0	0	0	0
288	0	140	163	0.0	0.0	25	0.0	0	0	0	0

-ABDOMINAL PHOTOPHORE=0 ANTERIOR EYE ORBIT PHOTOPHORE=0 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=0----------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	RTTENT	LFTENT	TOTLEN
430	1.2	0.0	0.0	1.8	2.3	0.0	0.7	1.5	1.5	5.9
431	4.1	7.0	13.6	5.3	4.9	0.0	1.7	0.0	0.0	0.0
432	4.5	8.0	12.5	4.4	5.0	0.0	1.8	0.0	0.0	0.0
433	4.0	7.8	12.0	3.8	4.6	1.0	1.6	0.0	0.0	0.0
434	5.5	5.8	10.0	4.0	5.4	0.0	1.8	0.0	5.5	18.2
435	3.5	2.2	5.4	2.4	3.3	0.0	1.0	0.0	3.0	10.5
436	8.0	12.0	19.0	6.8	7.8	1.2	4.0	0.0	0.0	38.3
437	7.2	15.3	25.4	7.7	8.2	1.0	4.1	0.0	0.0	44.8
438	5.3	9.8	18.0	5.0	7.1	0.0	3.2	0.0	0.0	32.5
439	3.0	2.7	8.0	2.7	2.6	0.0	1.0	0.0	4.1	12.1
440	3.6	5.4	11.0	4.0	4.3	0.0	1.3	3.1	3.1	14.3
441	7.0	17.5	17.5	7.4	7.4	0.0	3.1	0.0	0.0	28.3
442	4.8	7.8	15.6	4.8	5.4	0.0	2.1	0.0	0.0	34.2
443	4.5	4.9	8.6	2.9	5.0	0.0	1.7	4.8	0.0	15.4
444	2.6	3.5	7.7	2.6	2.8	0.0	1.1	1.9	1.9	9.7
445	4.0	6.8	0.0	3.9	5.1	0.0	1.7	0.0	0.0	0.0
446	1.4	0.0	0.0	1.3	1.2	0.0	0.3	0.8	0.8	0.0
447	3.1	4.5	8.8	3.3	3.6	0.0	1.5	0.0	0.0	0.0
448	2.8	1.2	2.4	1.8	2.8	0.0	1.0	4.2	4.0	6.0
449	1.4	0.0	0.0	1.0	2.1	0.0	0.7	2.3	0.0	5.8
450	1.1	0.0	0.0	0.7	1.7	0.0	0.5	1.4	1.6	4.1
451	0.0	0.0	0.0	0.9	1.1	0.0	0.3	1.0	1.0	3.6
452	0.0	0.0	0.0	0.7	1.0	0.0	0.3	0.0	0.0	0.0
453	0.0	0.0	0.0	1.4	1.5	0.0	0.6	2.0	2.0	5.8
454	0.0	0.0	0.0	1.0	1.3	0.0	0.3	1.5	1.5	3.9

-ABDOMINAL PHOTOPHORE=0 ANTERIOR EYE ORBIT PHOTOPHORE=0 EYEBALL PHOTOPHORE=0 ACCESSORY HOOK CUSPS=1----------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	RTTENT	LFTENT	TOTLEN
100	4.2	10.0	12.2	6.0	5.6	2	2.2	0	0	0
134	0.0	6.6	9.2	4.2	4.0	3	2.5	0	0	0
342	0.0	14.0	24.0	0.0	0.0	2	0.0	0	0	0
426	5.3	10.0	18.8	6.2	6.3	0	2.1	0	0	0

Octopoteuthis sp

--ABDOMINAL PHOTOPHORE=0   ANTERIOR EYE ORBIT PHOTOPHORE=0   EYEBALL PHOTOPHORE=0   ACCESSORY HOOK CUSPS=0----------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	RTTENT	LFTENT	TOTLEN
40	6.6	13.4	22.7	7.5	6.8	0.0	2.5	0.0	0.0	34.8
41	6.5	12.5	23.4	6.2	6.1	0.0	2.5	0.0	0.0	0.0
51	3.5	3.0	6.0	2.2	3.6	0.0	1.8	0.0	1.9	9.6
52	8.2	14.0	25.0	6.3	9.0	0.0	3.5	0.0	0.0	0.0
54	4.4	6.2	12.2	4.2	6.0	0.0	2.5	6.5	0.0	16.9
55	2.2	3.5	8.0	0.0	2.5	0.0	1.0	1.7	0.0	8.0
73	4.6	9.0	16.5	4.0	5.3	0.0	2.1	0.0	0.0	21.6
74	0.0	9.0	16.0	4.0	0.0	0.0	2.2	0.0	0.0	0.0
81	0.0	9.0	18.0	6.2	0.0	0.0	0.0	0.0	0.0	0.0
83	4.0	6.0	13.0	3.9	4.9	0.0	1.9	0.0	0.0	0.0
87	5.2	11.3	21.0	4.9	7.0	1.5	2.7	0.0	0.0	33.1
88	7.2	15.0	27.0	7.9	8.4	2.0	4.6	0.0	0.0	42.7
89	3.9	6.7	11.6	3.8	5.0	0.0	2.0	0.0	0.0	0.0
90	3.7	5.4	12.2	3.3	4.2	0.0	1.9	0.0	0.0	0.0
91	3.2	6.5	17.6	3.1	4.8	0.0	2.0	0.0	0.0	0.0
92	3.1	2.9	8.2	2.6	3.7	0.0	1.4	0.0	0.0	0.0
93	3.0	2.6	5.6	2.0	3.5	0.0	1.1	0.0	3.9	11.1
94	2.7	2.9	6.2	2.9	3.5	0.0	1.2	3.4	3.4	12.5
95	2.4	2.5	6.6	2.0	2.9	0.0	1.1	0.0	0.0	0.0
98	2.3	2.7	6.0	2.4	3.2	0.0	1.0	0.0	0.0	0.0
101	2.6	9.0	18.0	4.5	4.0	0.0	2.0	0.0	0.0	0.0
102	6.6	14.0	26.0	7.2	7.8	1.5	4.2	0.0	0.0	0.0
103	3.0	3.4	7.9	2.8	3.6	0.6	1.2	0.0	0.0	0.0
104	3.2	5.9	2.5	4.2	3.7	0.0	0.0	0.0	0.0	0.0
105	2.6	4.5	7.8	2.5	3.6	0.0	1.2	0.0	0.0	0.0
112	3.5	5.9	9.9	3.0	3.9	0.0	1.6	0.0	0.0	0.0
114	3.2	1.7	6.0	2.0	4.0	0.0	0.4	0.0	0.0	0.0
115	3.4	8.2	2.5	3.7	0.0	1.3	0.4	0.0	0.0	0.0
133	5.0	7.0	11.4	3.8	5.4	1.0	1.6	0.0	0.0	22.0
179	0.0	12.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
249	0.0	12.0	22.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
252	0.0	3.5	9.0	0.0	0.0	0.0	0.0	3.0	3.0	0.0
253	0.0	2.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
254	0.0	2.5	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
256	0.0	17.0	26.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
257	0.0	10.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	6.0	12.0	0.0	0.0	0.0	0.0	5.0	5.0	0.0
259	0.0	4.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
260	0.0	7.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	5.0	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
262	0.0	4.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
263	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
264	0.0	10.0	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
265	0.0	5.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
267	0.0	12.0	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
268	0.0	18.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
287	0.0	4.5	10.0	0.0	0.0	0.0	0.0	3.0	3.0	0.0
303	0.0	4.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
304	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
308	0.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
309	0.0	7.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
310	0.0	7.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
311	0.0	6.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Octopoteuthis sp

--ABDOMINAL PHOTOPHORE=0   ANTERIOR EYE_ORBIT PHOTOPHORE=0   EYEBALL PHOTOPHORE=0   ACCESSORY HOOK CUSPS=0----------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	RTTENT	LFTENT	TOTLEN
312	0.0	7.0	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
313	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
314	0.0	5.0	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
315	0.0	11.0	22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
316	0.0	4.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
317	0.0	7.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
318	0.0	8.0	23.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
319	0.0	4.0	9.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0
320	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
321	0.0	5.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
322	0.0	7.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
323	0.0	5.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
324	0.0	8.0	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
325	0.0	7.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
326	0.0	5.0	0.0	0.0	0.0	0.0	0.0	5.0	5.0	0.0
327	0.0	7.0	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
328	0.0	7.0	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
329	0.0	7.0	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
330	0.0	7.0	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
331	0.0	7.0	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
332	0.0	5.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
333	0.0	4.0	9.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0
335	0.0	4.5	11.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0
336	0.0	3.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
337	0.0	2.0	5.0	0.0	0.0	0.0	0.0	2.0	2.0	0.0
338	0.0	6.0	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
347	0.0	20.0	33.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0
367	0.0	13.0	26.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
370	0.0	12.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
395	5.0	6.0	12.8	5.0	5.0	0.0	2.0	5.2	5.2	24.3
396	2.5	0.0	3.5	2.8	2.6	0.0	1.3	3.5	3.5	12.0
404	2.8	3.7	8.9	3.0	3.6	0.0	1.3	0.0	0.0	0.0
406	7.5	12.5	21.0	6.3	7.3	0.0	3.3	0.0	0.0	3.8
407	6.1	11.0	19.1	5.6	6.8	0.0	3.1	0.0	0.0	36.4
408	8.0	15.5	26.5	7.5	8.5	0.0	4.3	0.0	0.0	46.0
409	4.5	7.8	15.4	4.3	6.0	0.0	1.1	0.0	0.0	0.0
410	2.0	1.7	2.2	1.8	2.2	0.0	0.8	0.0	0.0	0.0
411	3.6	7.6	9.2	4.2	4.8	0.6	1.8	0.0	0.0	0.0
413	2.7	3.5	6.0	3.4	4.0	0.0	1.0	0.0	0.0	0.0
414	3.2	4.0	8.8	3.4	4.3	0.0	1.4	0.0	0.0	0.0
415	2.8	3.6	8.3	3.5	3.8	0.0	1.0	0.0	0.0	0.0
416	0.0	0.0	0.0	1.0	1.9	0.0	0.7	1.9	1.9	5.6
417	0.0	6.3	14.0	5.2	0.0	0.0	0.0	0.0	0.0	0.0
418	0.8	0.0	0.0	1.0	0.0	0.0	0.4	0.0	0.0	0.0
419	5.9	11.2	6.3	6.6	7.0	0.0	1.9	0.0	0.0	26.4
420	4.5	8.3	14.4	5.7	5.2	0.0	2.1	0.0	0.0	0.0
422	1.1	0.0	0.0	0.7	1.3	0.0	0.4	1.4	1.4	3.0
423	0.0	0.0	0.0	1.0	1.1	0.0	0.3	1.2	1.2	3.6
424	0.0	0.0	0.0	8.6	7.4	0.0	3.9	0.0	0.0	0.0
425	3.2	3.8	9.8	2.8	3.7	0.0	1.4	0.0	0.0	0.0
427	0.0	0.0	0.0	1.6	1.2	0.0	0.4	1.3	1.3	5.1
428	3.4	5.2	11.2	4.4	4.5	0.0	1.4	0.0	0.0	0.0
429	2.5	3.2	7.3	2.8	3.5	0.0	1.1	0.0	0.0	0.0

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-ABDOMINAL PHOTOPHORE=2   ANTERIOR EYE ORBIT PHOTOPHORE=0   EYEBALL PHOTOPHORE=0   ACCESSORY HOOK CUSPS-0-- - - - -

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	RTTENT	LFTENT	TOTLEN
72	5.8	11.9	21.7	6.8	6.6	0	2.7	0	0	0.0
77	6.1	15.5	29.5	7.7	8.0	0	3.1	0	0	41.7
113	5.2	13.2	19.8	6.1	6.7	1	3.0	0	0	36.3
412	4.2	7.8	~~13.5~~	~~6.0~~	5.3	0	1.7	0	0	0.0

-ABDOMINAL PHOTOPHORE=2   ANTERIOR EYE ORBIT PHOTOPHORE=0   EYEBALL PHOTOPHORE=0   ACCESSORY HOOK CUSPS-1----------

SPECNO	MANWID	FINLEN	FINWID	HDLEN	HDWID	TAILLEN	EYEDIAM	RTTENT	LFTENT	TOTLEN
344	0	13	23	0	0	1	0	0	0	0
346	0	21	34	0	0	3	0	0	0	0